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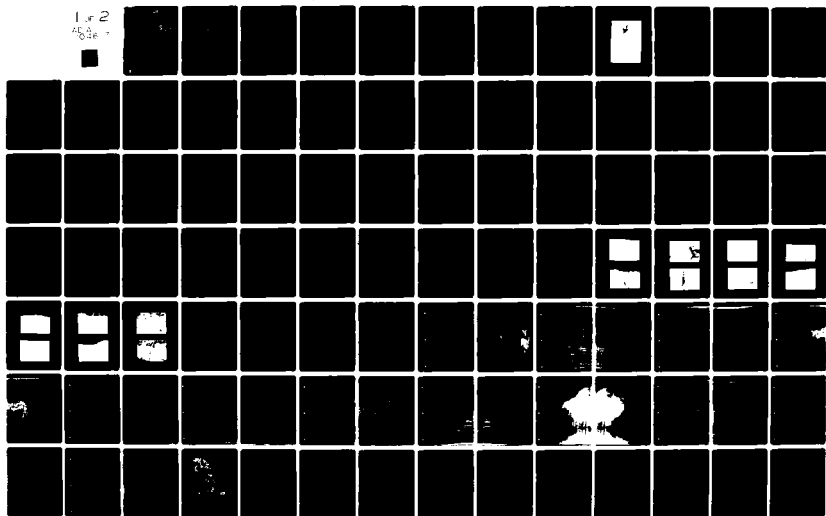
CONSOER TOWNSEND AND ASSOCIATES LTD ST LOUIS MO
NATIONAL DAM SAFETY PROGRAM, GENTRY LAKE DAM (MO 10213), MISSIS-ETC(U)
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MISSISSIPPI-SALT-QUINCY RIVER BASIN

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GENTRY LAKE DAM
LINCOLN COUNTY, MISSOURI
MO. 10213

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Gentry Lake Dam (Mo. 10213) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Gentry Lake Dam (Mo. 10213).

It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

28 AUG 1980
Date

APPROVED BY: SIGNED
Colonel, District Engineer

29 AUG 1980
Date

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GENTRY LAKE DAM
LINCOLN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10213

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
CONSOER, TOWNSEND AND ASSOCIATES, LTD.
ST. LOUIS, MISSOURI
AND
PRC ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

JULY 1980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Gentry Lake Dam, Missouri Inv. No. 10213
State Located: Missouri
County Located: Lincoln
Stream: An unnamed tributary of the Lost Creek
Date of Inspection: April 22, 1980

Assessment of General Condition


Gentry Lake Dam was inspected by the engineering firms of Consoer, Townsend and Associates, Ltd. and PRC Engineering Consultants, Inc. (A Joint Venture) of St. Louis, Missouri according to the U. S. Army Corps of Engineers "Engineer Regulation No. 1110-2-106" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Within the estimated damage zone of four miles downstream of the dam are four dwellings, five buildings, three barns, one quarry scale house, and a dam which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Gentry Lake Dam is in the small size classification since it is less than 40 feet and more than 25 feet high, and impounds more than 50 acre-feet but less than 1,000 acre-feet of water.

Our inspection and evaluation indicates that the spillway of Gentry Lake Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Gentry Lake Dam being a small size dam with a high hazard potential is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping. Considering the number of inhabited dwellings located downstream of the dam and another dam being located on the same stream approximately 1 mile downstream of the dam, the PMF is considered the appropriate spillway design flood for Gentry Lake Dam. It was determined that the reservoir/spillway system can accommodate approximately 80 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation also indicates that the reservoir/spillway system can accommodate the one-percent chance flood without overtopping.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Other deficiencies noted by the inspection team were the two larger sized bush plants on the downstream slope, old brush and logs in and around the principal spillway outlet, brush and trash on the downstream half of the emergency spillway channel, eroded areas in the vicinity of the emergency spillway discharge channel, livestock activities on the dam embankment, a need for periodic inspection by a qualified engineer and a lack of maintenance schedule. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct
or control the deficiencies described above.



Walter G. Shifrin, P.E.





Overview of Gentry Lake Dam

NATIONAL DAM SAFETY PROGRAM

GENTRY LAKE DAM, I.D. No. 10213

TABLE OF CONTENTS

<u>Sect. No.</u>	<u>Title</u>	<u>Page</u>
SECTION 1	PROJECT INFORMATION	1
	1.1 General	1
	1.2 Description of Project	3
	1.3 Pertinent Data	7
SECTION 2	ENGINEERING DATA	10
	2.1 Design	10
	2.2 Construction	10
	2.3 Operation	11
	2.4 Evaluation	11
SECTION 3	VISUAL INSPECTION	13
	3.1 Findings	13
	3.2 Evaluation	20

TABLE OF CONTENTS

(Continued)

<u>Sect. No.</u>	<u>Title</u>	<u>Page</u>
SECTION 4	OPERATION PROCEDURES	22
	4.1 Procedures	22
	4.2 Maintenance of Dam	22
	4.3 Maintenance of Operating Facilities	22
	4.4 Description of Any Warning System in Effect	23
	4.5 Evaluation	23
SECTION 5	HYDRAULIC/HYDROLOGIC	24
	5.1 Evaluation of Features	24
SECTION 6	STRUCTURAL STABILITY.	28
	6.1 Evaluation of Structural Stability.	28
SECTION 7	ASSESSMENT/REMEDIAL MEASURES.	31
	7.1 Dam Assessment	31
	7.2 Remedial Measures.	33

TABLE OF CONTENTS

(Continued)

LIST OF PLATES

	<u>Plate No.</u>
LOCATION MAP	1
PLAN AND ELEVATION OF DAM	2
EMBANKMENT SECTION AND SPILLWAY PROFILE	3
SCS AS-BUILT DRAWINGS AND OTHER INFORMATION	4-15
GEOLOGIC MAP	16-17
SEISMIC ZONE MAP	18

APPENDICES

APPENDIX A - PHOTOGRAPHS

APPENDIX B - HYDROLOGIC AND HYDRAULIC COMPUTATIONS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

GENTRY LAKE DAM, Missouri Inv. No. 10213

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Gentry Lake Dam was carried out under Contract DACW 43-80-C-0094 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of Consoer, Townsend & Associates, Ltd., and PRC Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Gentry Lake Dam was made on April 22, 1980. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, presents a summary of visual observations made during the field inspection, presents an assessment of hydrologic and hydraulic conditions at the site, presents an assessment of the structural adequacy of the various project features and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that in this report reference to left or right abutments is viewed as looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the west abutment or side, and right to the east abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Engineer Regulation No. 1110-2-106" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase 1 Dam Inspection.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based upon observations and measurements made during the visual inspection and from conversations with Mr. M. Gentry, the owner. "As-Built" drawings are included as part of this report. There were no major discrepancies between our field notes and the "As-Built" plans.

The dam consists of a zoned, rolled, earthfill embankment with a straight alignment between earthen abutments. Material was removed from the reservoir and local area for construction of the embankment, which, according to Mr. Gentry, includes an impervious clay core wall founded on bedrock. The shape of the dam's maximum cross-section is generally trapezoidal with a 14 foot top thickness and a structural height of 31 feet. The total horizontal distance along the axis at the top of dam was measured as 473 feet; the elevation at the top of dam is 724.5 feet above mean sea level (M.S.L.)

The upstream slope was measured as 1.0 V to 2.8 H to the berm and the downstream slope as 1.0 V to 2.1 H. A 10-foot wide berm was constructed on the upstream slope approximately 13 feet below the top of dam.

Included in the length measurement along the axis is an emergency spillway, trapezoidal in shape, cut into the dam at the right abutment. This spillway is a grass-lined open channel with a measured 79-foot top width and 33 foot spillway crest width, which is approximately 5.5 feet below the top of dam. The left and the right side slopes of the channel is 1.0 V to 3.5 H and 1.0 V to 4.9 H respectively.

The principal spillway for Gentry Lake Dam is an 18 inch concrete conduit laid through the embankment with seepage collars placed on bedrock. The spillway intake is about 294 feet right of the left abutment and consists of a drop inlet concrete standpipe with a 12 foot drop (Photo 6). The concrete standpipe, also founded on bedrock (see Plate 9), has a 36-inch inside diameter and joins to the 18-inch diameter concrete conduit, which then outlets into a 4 foot deep, 25 foot diameter pool near the toe of the embankment (Photo 7). Using field measurements, the length of the 18 inch conduit was calculated as 122 feet. Affixed to the top of the standpipe is a metal trashrack and concrete anti-vortex wall combination. The wall is 4 inches thick, 2 feet high and about 12 feet in length, and is oriented in the direction of the 18 inch pipe. The trashrack, bolted to the anti-vortex wall, consists of welded steel channels (Photo 6).

There are no low level outlets, gates, or other appurtenant structures associated with this dam.

b. Location

Gentry Lake Dam is located in Lincoln County in the State of Missouri, and crosses an unnamed tributary of Lost Creek. The small community of Elsberry is about seven miles to the east. The Gentry Lake Dam location on the 7.5 minute series of the U.S. Geological Survey maps is found in Section 7 of Township 50 North, Range 2 East, of the Luckett Ridge, Missouri Quadrangle Sheet.

c. Size Classification

The impoundment of Gentry Lake Dam is less than 1,000 acre-feet but more than 50-acre feet, and the height is within the 25 to 40 foot range. Therefore the size is determined to fall in the "small" category, according to the "Engineer Regulation No. 1110-2-106, Appendix D" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with this classification. Within the estimated damage zone, extending four miles downstream of the dam, are four dwellings, five buildings, three barns plus another dam and a quarry scale house.

e. Ownership

Gentry Lake Dam and Reservoir is privately owned. The owner's name is Moebius Gentry; his address is as follows: R.F.D. 1, Elsberry, Missouri, 63343.

f. Purpose of Dam

The dam was constructed as a flood control structure, however, the reservoir is also used for a livestock drinking water supply.

g. Design and Construction History

Gentry Lake Dam was designed by the Department of Agriculture, Soil Conservation Service as part of the Lost Creek Watershed Protection Project. Mr. Bernard Browning was the Soil Conservation Service engineer for the project. According to the owner, Mr. Moebius Gentry, the dam was constructed between July, 1959 and September, 1959 by Gamett & Wilson Construction Company, of Clark County, Missouri.

h. Normal Operational Procedures

Normal procedure is to allow the reservoir to remain as full as possible with the water level being controlled by rainfall, runoff, evaporation and the elevation of the principal spillway crest.

1.3 Pertinent Data

a. Drainage Area (square miles):. 0.29

b. Discharge at Damsite

Estimated experienced maximum flood (cfs): 30

Estimated ungated spillway capacity with
reservoir at top of dam elevation (cfs): 1985

c. Elevation (Feet above MSL)

Top of dam (minimum):. 724.5

Spillway crest:

Principal Spillway 709.5

Emergency Spillway 719.0

Normal Pool: 709.5

Maximum Experienced Pool:. 716.0

Observed Pool 709.5

d. Reservoir

Length of pool with water surface
at top of dam elevation (feet):. 1100

e. Storage (Acre-Feet)

Top of dam (minimum):. 123

Spillway crest:

Principal Spillway 17

Emergency Spillway 70

Normal Pool: 17

Maximum Experienced Pool 48.5

Observed Pool. 17

f. Reservoir Surfaces (Acres)

Top of dam (minimum):. 11.7

Spillway crest:

Principal Spillway	3.5
Emergency Spillway	7.9
Normal Pool:	3.5
Maximum Experienced Pool:.	6.4
Observed Pool:	3.5

g. Dam

Type:	Rolled, Earthfill
Length:	473 feet
Structural Height:	31 feet
Hydraulic Height:	31 feet*
Top width:	14 feet
Side slopes:	
Downstream	1V to 2.1H (measured to berm)
Upstream	1V to 2.8H (measured to berm)
Zoning:	a. Impervious clay core (according to Mr. Gentry)
	b. Upstream and downstream clay and chert shells
Impervious core:	yes
Cutoff:	A core trench 4-foot deep with 10-foot bottom width and side slopes of 1H to 1V.
Grout curtain:	no
Freeboard above normal reservoir level:	15 feet
Volume:	24,259 cu.yds. (according to as-built plans)

h. Diversion and Regulating Tunnel	None
------------------------------------	------

i. Spillway

Type:

Principal Spillway Drop inlet, uncontrolled
Emergency Spillway Earthcut channel, uncontrolled

Length of crest:

Principal Sp'illway 3-foot diameter standpipe with
an 18-inch diameter connecting
pipe
Emergency Spillway 33 feet

Crest Elevation (feet above MSL):

Principal Spillway 709.5
Emergency Spillway 719.0

j. Regulating Outlets . . . None

- * The hydraulic height of the dam is the vertical distance from the lowest point on the downstream toe to the top of the dam or the maximum water surface, if below the top of the dam.

SECTION 2: ENGINEERING DATA

2.1 Design

"As-built" drawings are available from the Department of Agriculture, Soil Conservation Service, and are included as part of this report. The drawings were prepared in April, 1958 by the Department of Agriculture, Soil Conservation Service. Geologic and soil mechanics reports were prepared for this dam by the Department of Agriculture, Soil Conservation Service, however, they were not available during the preparation of this report.

2.2 Construction

No data is available concerning the construction of the dam and appurtenant structures, other than the "As-built" drawings, and the information obtained from Mr. Gentry.

According to Mr. Gentry, the embankment consists of three zones as follows: an impervious core, and an upstream and a downstream shell. The core was constructed of a clay material removed from the right abutment area and the two shells were constructed of a clay and chert material removed from the reservoir. The embankment was compacted by a sheepfoot roller and density tests were taken at an interval of at least one per day. A 4-foot deep core trench was excavated to bedrock (shale) and parallel to the dam axis. This corresponds to what is shown on the "As-built" drawings. The trench has a bottom width of 10 feet and side slopes of 1V to 1H.

2.3 Operation

No operation records are available for Gentry Lake Dam.

2.4 Evaluation

a. Availability

The availability of engineering data is fair and consists of the "As-built" drawings mentioned in Section 2.1, State Geological Maps and U.S.G.S. Quadrangle Sheets. Geologic and soil mechanics reports for this dam were prepared by the Department of Agriculture, Soil Conservation Service, however, they were not available during the preparation of this report. Information on design hydrology and hydraulic design is available and is included in this report (Plate 13 and 14). Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams", were not available which is considered a deficiency.

b. Adequacy

The conclusions presented in this report are based on field measurements, the available engineering data, past performance and present condition of the dam. The available data including the field measurements taken by the field inspection team are considered adequate to evaluate the hydraulic and hydrologic capabilities of the dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Validity

A set of "As-built" drawings and information on design hydrology and hydraulic design were available for review. From field measurements and conversations with the owner, the dam appears to have been constructed according to the available drawings, except for the discrepancies described in Section 6.1b. Gentry Lake Dam was originally Structure E-1 according to the "As-built" drawings provided by the Soil Conservation Service.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Gentry Lake Dam was made on April 22, 1980. The following persons were present during the inspection:

<u>Name</u>	<u>Affiliation</u>	<u>Disciplines</u>
Dr. M.A. Samad	PRC Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Mark R. Haynes	PRC Engineering Consultants, Inc.	Soils and Mechanical
Robert McLaughlin	PRC Engineering Consultants, Inc.	Civil
Razi Quraishi	PRC Engineering Consultants, Inc.	Geology
John Lauth	Consoer, Townsend & Assoc., Ltd.	Civil and Structural
Moebius Gentry	Owner	

Specific observations are discussed below.

b. Dam

The dam is well maintained and is generally in good condition. The top of dam area shows no vehicular wear in the grass cover protection which seems to be adequate (Photo 1). No cracking or misalignments in either the vertical or horizontal directions were apparent during the visual inspection; also there were no localized settlements or bulges observed. According to Mr. Gentry, not only has there never been an occurrence of overtopping, but the emergency spillway has never been used. There was no evident animal burrowing activity.

The upstream slope has adequate grass cover; however, there are livestock trails in the vicinity of the berm near the water's edge (Photo 2). Although this presents no hazards, it is mentioned because some portions of the berm seemingly have been cut back, as much as six to ten feet, by the cutting effect of the hooves of cattle. This condition has allowed a small amount of erosion to occur due to wave action. Also, there is a pile of old logs and rubbish stored behind the trashrack; this poses a slight potential problem as there is no trashrack cross-bar to block entry into the drop inlet from the rear. No bulges, depressions or other irregularities were observed.

The downstream slope also has adequate grass cover. Although no seepage was encountered either on the slope or downstream of the toe, there are two fairly good sized shrubs growing on the slope (Photo 5). No bulges, depressions, or other signs of instability were apparent. Some livestock paths were worn into the slope itself and along the line of intersection of the dam and emergency spillway fill (Photo 10). No animal burrows were observed.

Both abutments slope gently upward from the crest of the dam. No instabilities or seepage were observed on either abutment. One erosion gully was observed on the right abutment several feet to the right of the emergency spillway. The erosion did not appear to affect the safety of the emergency spillway, dam, or abutment.

No rodent activity was apparent on the abutments. According to Mr. Gentry, there has been some muskrat activity in the reservoir in the past. The muskrats are trapped during the winter when present.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on an unnamed tributary of Lost Creek in the Dissected Till Plains Section of the central Lowland Physiographic Province. Loess-mantled Kansas drift covers the surface of most of the Dissected Till Plains Section. This section is distinguished from the Young Drift Section to the north and from the Till Plains on the east by the stage it has reached in the post-glacial erosion cycle. Broadly generalized, this section is a nearly flat till plain submature to mature in its erosion cycle.

The regional bedrock geology beneath the glacial outwash deposit in the damsite area as shown on the Geologic Map of Missouri (1979) (Plate 16) consists of Mississippian Burlington limestone, Fern Glen Formation, and Ordovician rocks consisting of interbedded limestone, sandstone, and shale.

The topography at the damsite is rolling with V- to U-shaped valleys. Elevation ranges from 930 feet above M.S.L. (2 miles northeast of the site) to about 720 feet above M.S.L. at Gentry Lake. The reservoir slopes are generally 10° to 15° from horizontal. The area near the damsite is covered with slope wash deposits of glacial-fluvial and loess origin, consisting of brown, silty, fine sand with brown sandstone fragments. Inlet and outlet areas of the unnamed tributary of Lost Creek exhibits Quaternary Alluvium. Outcrops of Ordovician Maquoketa Shale are exhibited at the downstream channel of the spillway and at the inlet areas of a southeasterly creek. Maquoketa Shale exhibited at the site consists of yellowish gray, moderately hard, thinly laminated, horizontally bedded Calcareous to Dolomitic shale with local lenses of limestone (Photos 13 and 14).

No faults have been identified in the vicinity of the damsite. The closest trace of a fault to the damsite is the Cap Au Gres faulted flexure nearly 5 miles southwest of the site. The Cap Au Gres faulted flexure had its last movement in post-Pennsylvanian, pre-Pleistocene time. Thus, the fault appears to have no effect on the dam.

Gentry Lake Dam consists of a zoned earthfill embankment and a grass lined spillway which is located at the right end of the embankment.

Based on the visual inspection, construction drawings and from the personal communication with the owner, Mr. Gentry, the embankment probably rests on gray, hard Maquoketa Shale. The foundation materials underneath the spillway area is compacted embankment fill (brown clayey silt, some fine sand).

(2) Project Soils

According to the "Missouri General Soil Map and Soil Association Descriptions" published by the Soil Conservation Service, the materials in the general area of the dam belong to the soil series of Menfro-Winfield-Lindley in the central Mississippi Valley wooded slopes family. The soils were basically formed from loess and glacial till. The permeability of these soils range from moderate to moderately slow. The Lindley soil is generally quite susceptible to erosion. If the Lindley soil type was used in the embankment, the potential of failure of the embankment would be increased due to erosion during overtopping.

Materials removed from the embankment on the upstream and downstream slopes approximately 1 foot below the vegetative cover appeared to be a brownish clayey silt with some fine sand. Based upon the Unified Soil Classification System, the soil would probably be classified as an ML-CL. This soil type generally has the following characteristics: impervious with a coefficient of permeability less than 1.0 foot per year; medium to low shear strength; and an intermediate resistance to piping.

d. Appurtenant Structures

(1) Principal Spillway

The principal spillway seemed to be in generally good shape. No major cracks were seen in the concrete in either the standpipe overflow rim or the anti-vortex wall, although some minor pitting was observed in the wall. Also, the metal trashrack, bolted to the wall, had no protective coating and a moderate amount of rust was present along with

possible corrosion at the water line (Photo 6). According to the "As-built" plans, paragraph 2.1, the spillway conduit was tongue and groove, reinforced concrete, culvert pipe, constructed on a reinforced concrete cradle (Type II) base with an unreinforced joint block at the point where the invert slope changes; two 6.5 foot by 12.0 foot reinforced concrete anti-seep collars were also constructed. Although there was no internal inspection of the conduit, it is assumed that all is functioning as it should; nothing to the contrary could be observed.

The spillway flow outlets from the conduit, dropping approximately eight inches into the stilling pool, before continuing into the downstream channel. The pool edge seems to be sloughing off due either to livestock activity or erosion, or both (Photo 7).

(2) Emergency Spillway

The emergency spillway conveys excess water flows beyond the toe of the dam through a grassed open channel (Photo 9). Although the spillway has never been needed during the life of the dam, it appears to be in good shape for the most part. The left side of the spillway channel was constructed with embankment fill material which looks to be in stable condition except for a large slough area observed at the end of the constructed channel (Photo 10). After conveying the excess flows past the dam, the emergency channel turns towards the downstream channel. At this point the emergency channel continues as a rough cut or eroded gully which is filled with trash and brush (Photo 11).

The soils in the emergency spillway channel appear to be silty clay. The channel has a good cover of grass. However, the spillway channel may be subject to erosion due to high velocity flows through the spillway during a large flood.

(3) Outlet Works

There were no regulated outlet works or low level drain pipes constructed in this dam.

e. Reservoir Area

The reservoir water surface elevation at the time of inspection was 709.5 feet above M.S.L.

The surface area of the reservoir at normal water level is about 3-1/2 acres. The rim seems to be stable as no severe erosive areas were observed. The land around the reservoir slopes gently to the rim and is grass and/or tree covered. There are no homes built in close proximity to the reservoir (Photo 8).

f. Downstream Channel

The downstream channel is well defined. The channel has a bottom width of about 5 feet and has a side slope of 1V to 1H on the right side and a side slope of 1V to 2H on the left side. The channel is approximately 3 feet deep. Some trees were observed growing on the channel, however, the trees will not significantly affect the hydraulic efficiency of the channel (Photo 12).

3.2 Evaluation

The visual inspection uncovered nothing of a consequential nature which would require immediate remedial action. However, some conditions were observed which could adversely affect the dam in the future and these should be corrected within a reasonable period of time.

1. There are two larger sized bushes presently growing on the downstream slope plus numerous smaller (approximately 8 inches) bush type plants (perhaps of the same variety as the larger). It does not seem likely that there is any present threat to the safety of the dam from this plant growth, however, the slope should generally be kept clear of all larger plant growth (Photo 5).

2. There seems to be a surplus of old brush and logs in and about the principal spillway inlet; the trashrack has no horizontal member which would prevent entry of the logs into the drop inlet from the slope side of the trashrack (Photo 4). If these logs were to be washed into the inlet, serious reduction in capacity would likely result.

3. The emergency spillway channel should be maintained in a clean condition; presently, there exists within the latter half of this channel an aggregate amount of brush and trash more or less clogging the channel area at one point. Although this condition does not present a hazard, it could be the cause of some real problems in the event the emergency spillway is required for use in the future. The sloughing of the embankment slope of the emergency channel in this same area has caused a break area in the ground surface where there is no grass protection. This condition could be the beginning of a problem gradually increasing in severity in this area (Photos 10 and 11).

4. Another potential problem arises from the fact that livestock paths have been worn into the dam on both the upstream and downstream slopes, and the edges of the embankment (both upstream and downstream) at water level are being broken off by the hooves of the stock. Both the broken edges and the worn paths provide excellent conditions for erosive action (Photo 3).

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Gentry Lake Dam was constructed to impound water for flood control as part of the Lost Creek Watershed Protection Project. There are no specific procedures which are followed for the operation of the dam. The water level is controlled by rainfall, runoff, evaporation and the elevation of the principal spillway.

4.2 Maintenance of Dam

The dam is maintained by the owner, Mr. Moebius Gentry. The dam crest and slopes are kept clear of trees, bushes and weeds. However, two larger sized bushes were observed growing on the downstream slope of the embankment. Mr. Gentry also cleans and removes the debris from the trashrack at the drop inlet. There have not been any repairs done to the dam since its original construction.

4.3 Maintenance of Operating Facilities

The only facility at the damsite which requires maintenance is the trashrack of the drop inlet structure. Debris must be periodically removed from the trashrack. There are no outlet works at this dam.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any warning system in use at the dam site.

4.5 Evaluation

The maintenance at Gentry Lake Dam appears to be adequate, however, the remedial measures described in Section 7 should be undertaken to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of the Gentry Lake Dam upstream from the dam axis consists of approximately 183 acres. The watershed area is mostly wooded with some pasture and range land. Land gradients in the watershed average roughly 5 percent. The Gentry Lake Dam Reservoir is located on an unnamed tributary of the Lost Creek. The reservoir is about 1-1/2 miles upstream from the confluence of the unnamed tributary and the Lost Creek. The watershed is 0.60 mile long. A drainage map showing the watershed and the downstream hazard zone is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Gentry Lake Dam was based upon criteria set forth in the Corps of Engineers' "Engineer Regulation No. 1110-2-106" and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based upon criteria given in the Corps of Engineers' EM 1110-2-1411 (Standard Project Storm). The Soil Conservation Service (SCS) method was used for deriving the unit hydrograph, utilizing the Corps of Engineers' computer program HEC-1 (Dam Safety Version). The unit hydrograph parameters are

presented in Appendix B. The SCS method also was used for determining the loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group of the watershed and the SCS curve number are presented in Appendix B. The curve number, unit hydrograph parameters, the PMP index rainfall and the percentages for various durations were directly input to the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak inflow of the PMF and one-half of the PMF are 3,919 cfs and 1,960 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method also utilizing the HEC-1 (Dam Safety Version) computer program. A storm of 50 percent and 25 percent PMF, respectively, preceded the PMF and 50 percent PMF by four days. The reservoir was assumed at the mean annual high water level at the beginning of the antecedent storm. The mean annual high water level for Gentry Lake was estimated to be at the crest of the principal spillway. The antecedent 50 percent PMF storm, when routed through the reservoir, will leave the reservoir at approximately the same elevation as the crest of the principal spillway (See Appendix B) at the end of the four day period. Thus the reservoir was assumed at the crest level of the principal spillway at the start of the routing computation for PMF, one-half of the PMF and other PMF ratio floods. The peak outflow discharges for the PMF and one-half of the PMF are 2,789 and 1,135 cfs, respectively. Only the PMF when routed through the reservoir resulted in overtopping of the dam.

The size of physical features utilized to develop the stage-outflow relation for the spillway and overtopping of the dam were prepared from field notes and sketches prepared

during the field inspection and available "As-built" drawings obtained from the Soil Conservation Service. The reservoir elevation-capacity data were taken from Soil Conservation Service hydrologic design data for the dam. The stage capacity data were extended by using the U.S.G.S. Lockett Ridge, Missouri Quadrangle topographic map (7.5 minute series). The spillway and dam overtop-rating curve and the reservoir-elevation-capacity curve are presented as Plates 2 & 3, respectively, in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam must aim at avoiding overtopping. Overtopping is especially dangerous for an earth dam because of its erodable characteristics. The safe hydrologic design of an embankment dam requires a spillway discharge capability combined with an embankment crest height that can handle a very large and exceedingly rare flood without overtopping.

The Corps of Engineers designs dams to safely pass the Probable Maximum Flood that could be generated from the dam's watershed. This is generally the accepted criterion for major dams throughout the world and is the standard for dam safety where overtopping would pose any threat to human life. Accordingly, the hydrologic requirement for safety for this dam is the capability to pass the Probable Maximum Flood without overtopping.

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this site. However, according to the owner, the maximum reservoir level was about 6-1/2 feet above the crest of the principal spillway.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1d and evaluated in Section 3.2.

d. Overtopping Potential

As indicated in Section 5.1.a, only the Probable Maximum Flood when routed through the reservoir, resulted in overtopping of the dam. The peak outflow discharges for the PMF and one-half of the PMF are 2,789 and 1,135 cfs, respectively. The maximum capacity of the spillway just before overtopping the dam is 1985 cfs. The PMF overtopped the dam by half a foot. The total duration of overflow over the dam is 20 minutes during the occurrence of the PMF. The spillway/reservoir system of Gentry Lake Dam is capable of accommodating a flood equal to approximately 80 percent of the PMF just before overtopping the dam. The reservoir/spillway system of Gentry Lake Dam will accommodate the one percent chance flood without overtopping.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately four miles downstream of the dam. Within the damage zone are four dwellings, five buildings, three barns, one quarry scale house and another dam (MO 10972).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlements, misalignments, cracking or other types of distress observed on any part of the embankment or foundation during the visual inspection. The top of dam shows no signs of use by any kinds of vehicular traffic; it is covered with a grass vegetation as are both the upstream and the downstream slopes (Photo 1). Some method of preventing livestock from entering the embankment area would probably have a constructive effect on the surface condition of the dam. Although stock animals have done nothing as yet to seriously affect the dam, their continued trampling can have nothing but overall negative effects.

As far as could be observed, the spillway conduit, the intake, and the outlet area and pool seem to be in a structurally sound condition. Also, the portion of the emergency spillway in the vicinity of the dam embankment was observed to be in good condition. It was mentioned by Mr. Gentry, however, that the emergency spillway has never been used during the life of the dam.

b. Design and Construction Data

Some design assumptions and hydrologic and hydraulic analyses from the project records were made available and these are included in the report (Plates 4 to 15). However, seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. Embankment and foundation soil parameters, construction test result data, and specifications relating to the degree of embankment compaction were not available for use in a stability analysis.

The "As-Built" drawings mentioned in paragraph 2.1 aided in ascertaining an evaluation of the structural components of the dam and appurtenances. They helped to verify the correctness of measurements, to show location of bedrock, to determine whether or not certain concrete members were reinforced, to give an idea of the quantities involved, and to show the overall method of construction used. Field measurements taken were in general agreement with the "As-Built" plans, although there were some minor disagreements; e.g. the top thickness was measured as 14 feet vs. 13 feet on the plans; "As-Built" drawings show the settled top of dam elevation as 723.3 feet above M.S.L. whereas, the field measurements result in an elevation of 724.5 feet above M.S.L. (assuming as correct the "As-Built" elevation for the drop inlet rim). From a review of the "As-Built" drawings for Gentry Lake Dam, coupled with an on-site inspection, the dam and appurtenant structures appear to be structurally sound.

c. Operating Records

No operating records were available relating to the stability of the dam or appurtenant structures. The water level on the day of the visual inspection was approximately one-half inch more or less above the intake, which was 15 feet below the top of dam. This is considered to be the normal operating level; however, the water has apparently been from four to six feet above the intake level at its highest point in recent years according to Mr. Gentry. The reservoir would normally be controlled at the level of the crest of the overflow pipe. The dam apparently has never seeped.

d. Post Construction Changes

No post construction changes were in evidence nor did the owner remember any having taken place.

e. Seismic Stability

The dam is located in Seismic Zone 2 (Plate 18), as defined in "Recommended Guidelines For Safety Inspection of Dams" as prepared by the Corps of Engineers, and will not require a seismic stability analysis. An earthquake of the magnitude which would be expected in Seismic Zone 2 should not cause significant distress to a well designed and constructed earth dam. Available literature indicates that no active faults exist near the vicinity of the damsite.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends upon numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Gentry Lake Dam is found to be "Inadequate". The spillway/reservoir system will accommodate approximately 80 percent of the PMF without overtopping the dam. The surface soils in the embankment and the emergency spillway appears to be silty clay. The emergency spillway and the dam embankment have a good cover of grass. The dam is overtopped by half a foot during the occurrence of the PMF. The maximum velocity of flow in the

emergency spillway during PMF will be about 10 ft/sec. The emergency spillway channel may be subject to erosion due to high velocity of flow during the PMF. The dam may also be susceptible to erosion due to high velocity of flow on its downstream slope, due to overtopping of the dam during the PMF. However, it is possible that no significant degradation of the dam crest or the spillway will occur due to short duration of overtopping (20 minutes) and short duration of high velocity flow (approximately 3-1/2 hours over 7 ft/sec during PMF) through the spillway.

A quantitative evaluation of the safety of the embankment could not be made in view of the absence of seepage and stability analyses. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions and made a matter of record. The present embankment and appurtenant structures, however, reportedly have performed satisfactorily since their construction; there have been no failures or evidence of instability. Reportedly, the dam has never been overtopped and no evidence indicating the contrary was observed.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurement, past performance and the present condition of the dam. Some information on the design hydrology and hydraulic design of the dam was available, and this information was considered good, and hydrologic and hydraulic data from this information were used for Phase I hydrologic and hydraulic evaluation of the dam. However, seepage and

stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time, and the item recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based upon results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

Spillway capacity should be increased to pass the PMF without overtopping the dam.

b. O & M Procedures

1. The two larger sized bush plants on the downstream slope should be removed and prevented from continued growth. Other bushes of smaller size should be prevented from excessive growth.

2. Any logs and brush behind and inside the principal spillway inlet should be removed.
3. Brush and trash should be removed from the downstream half of the emergency spillway channel.
4. Deterioration of erodible areas in the vicinities of the emergency spillway channel, the livestock paths, and edges of the embankment (both upstream and downstream), should be checked and repaired.
5. Some action should be taken in order to prevent livestock from any continued activity on the dam embankment.
6. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.
7. The owner should initiate the following programs:
 - (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.
 - (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

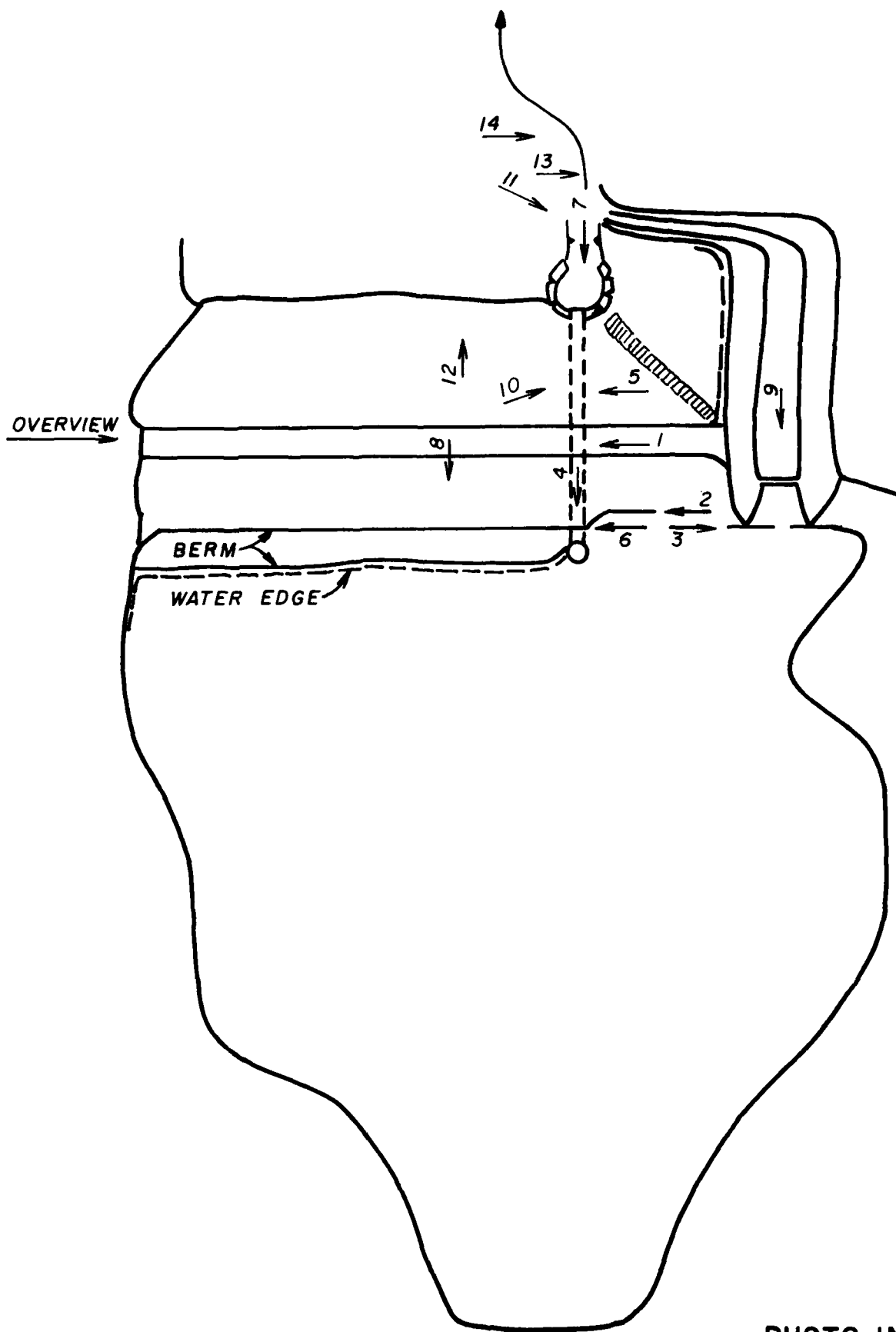


PHOTO INDEX
FOR
GENTRY LAKE DAM

Gentry Lake Dam

Photographs

- Photo 1 - Top of dam showing left abutment contacts and entry from street.
- Photo 2 - Upstream slope showing livestock trails and principal spillway.
- Photo 3 - View of berm breakoff area and livestock paths in vicinity of right abutment upstream contact.
- Photo 4 - View from rear of spillway trashrack showing logs and lack of horizontal bar.
- Photo 5 - Downstream slope displaying large plant growth and more livestock trails.
- Photo 6 - View of principal spillway morning glory inlet with antivortex wall and trashrack.
- Photo 7 - View of spillway outlet and stilling pool showing top of dam, stock trails, and erosive areas in pool edge.
- Photo 8 - View of reservoir and rim area taken from dam.
- Photo 9 - Inlet area of emergency spillway.
- Photo 10 - View of right abutment downstream slope, livestock trails, emergency spillway embankment, and sloughed earth in vicinity of emergency spillway outlet.

- Photo 11 - Brush and trash in outlet channel of emergency spillway and slough area.
- Photo 12 - Overview of downstream channel area of Lost Creek tributary.
- Photo 13 - Downstream channel outcrop of Ordovician Maquoketa shale bedrock.
- Photo 14 - Same as Photo 11, but further downstream.

Gentry Lake Dam

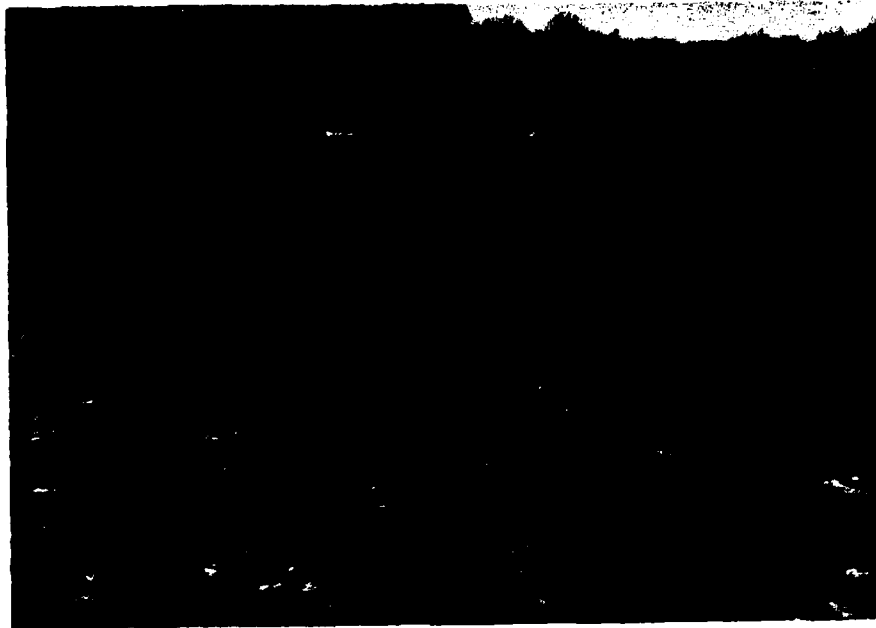


Photo 1

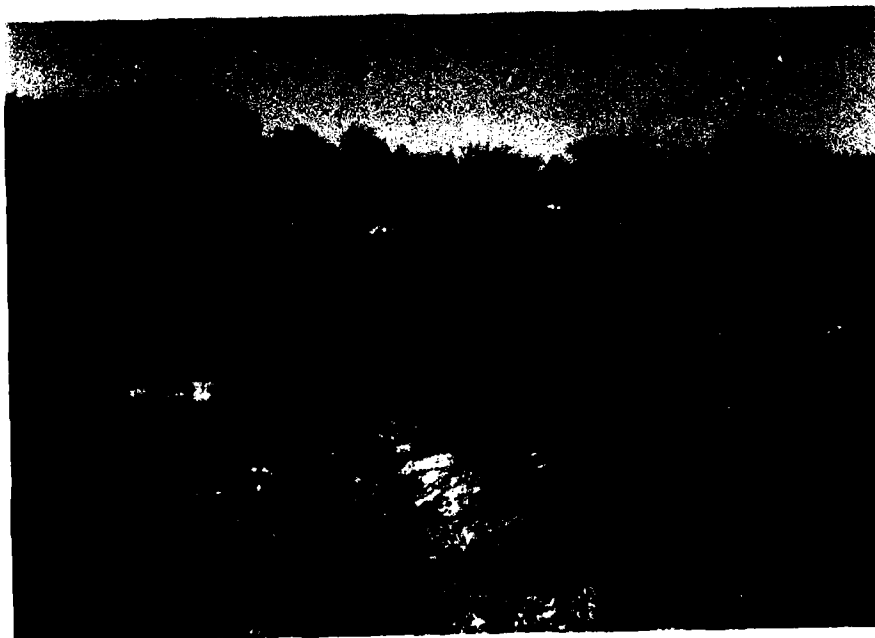


Photo 2

Gentry Lake Dam



Photo 3

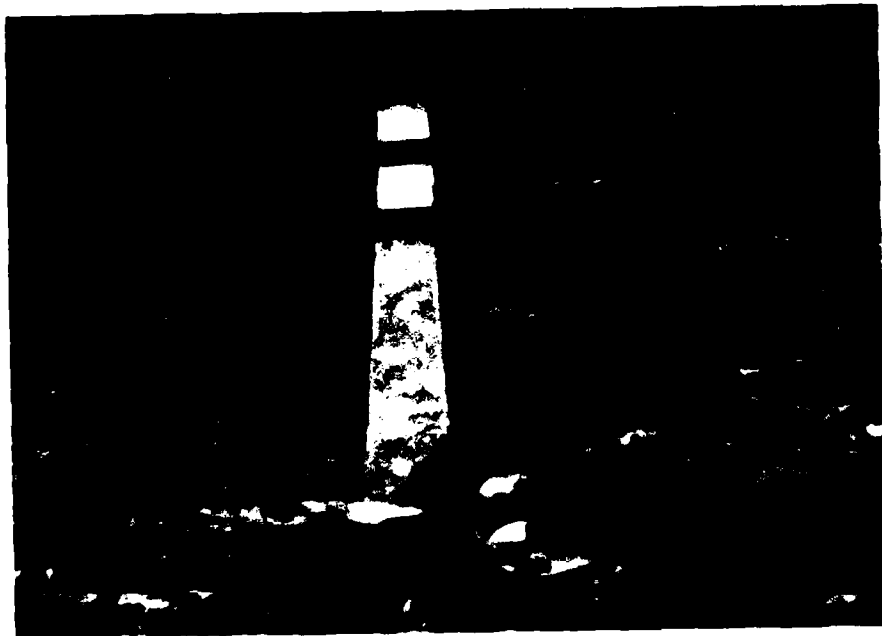


Photo 4

Gentry Lake Dam

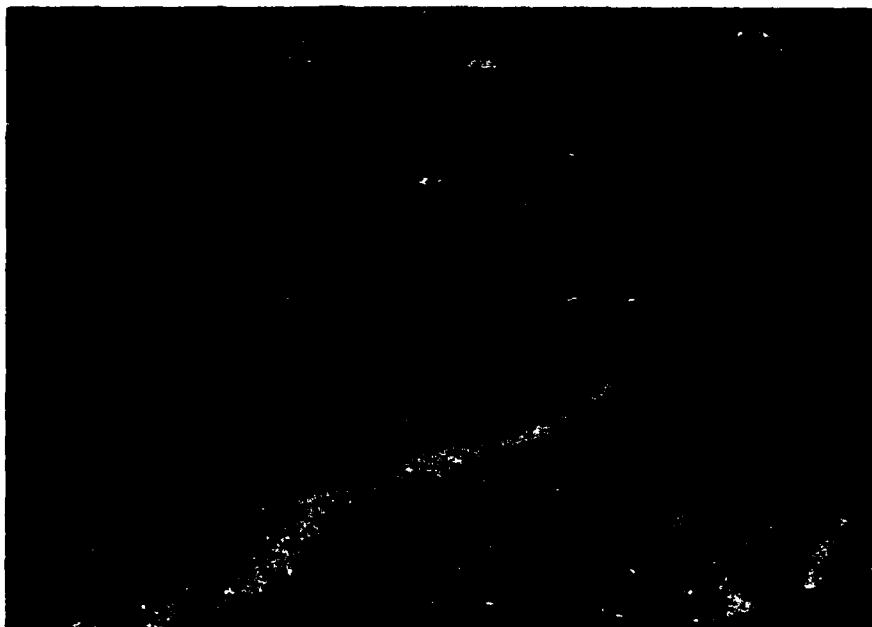


Photo 5

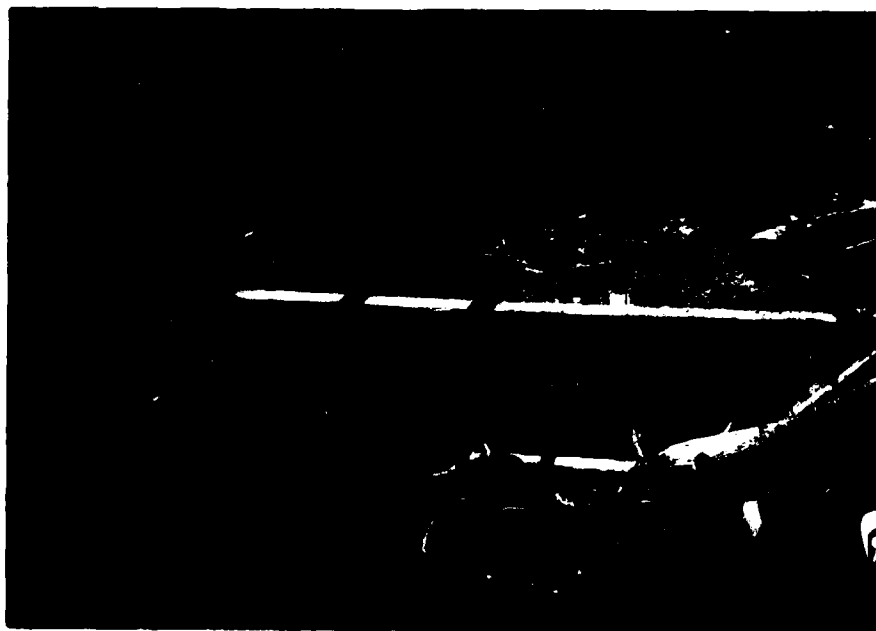


Photo 6

Gentry Lake Dam

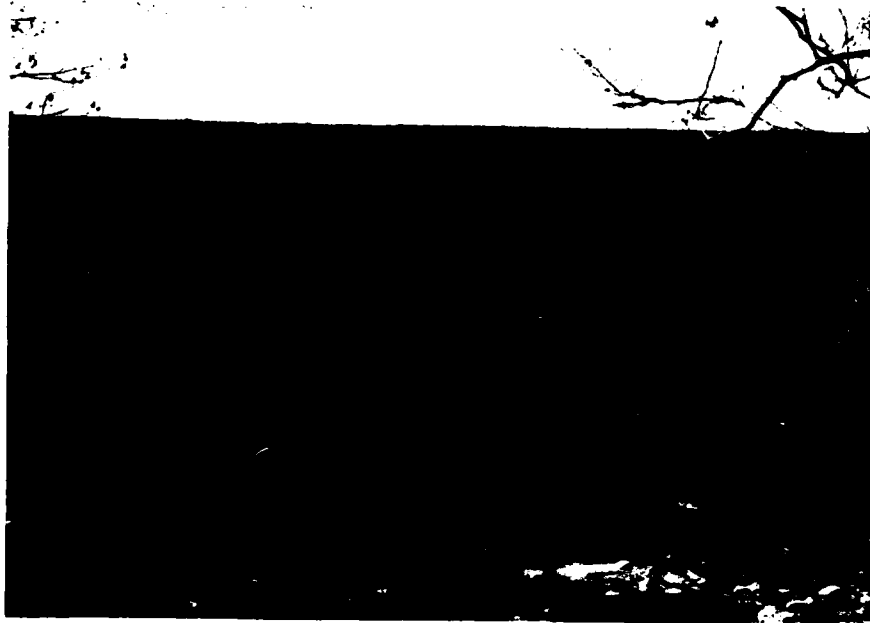


Photo 7



Photo 8

Gentry Lake Dam



Photo 9



Photo 10

Gentry Lake Dam



Photo 11



Photo 12

Gentry Lake Dam

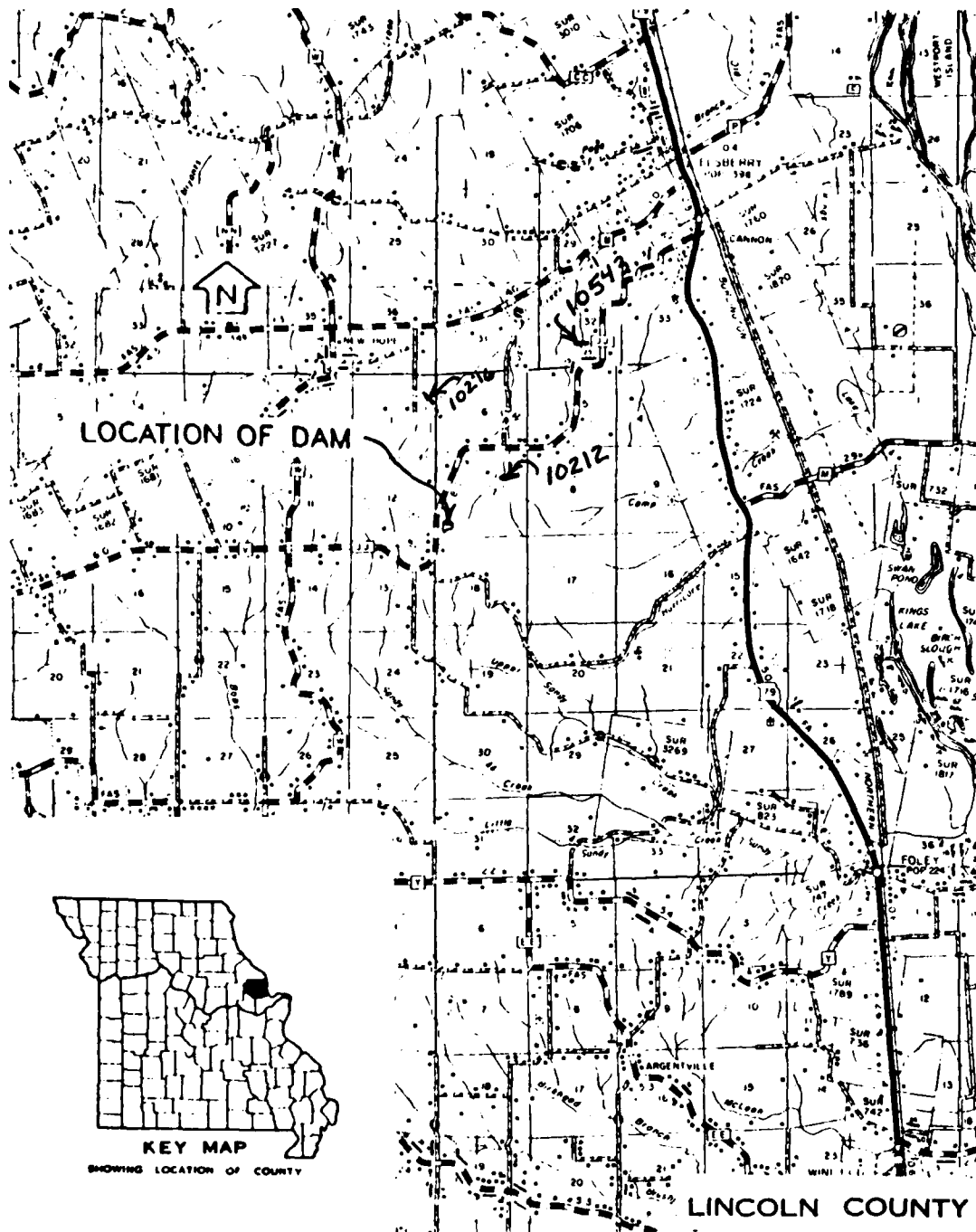


Photo 13



Photo 14

PLATES

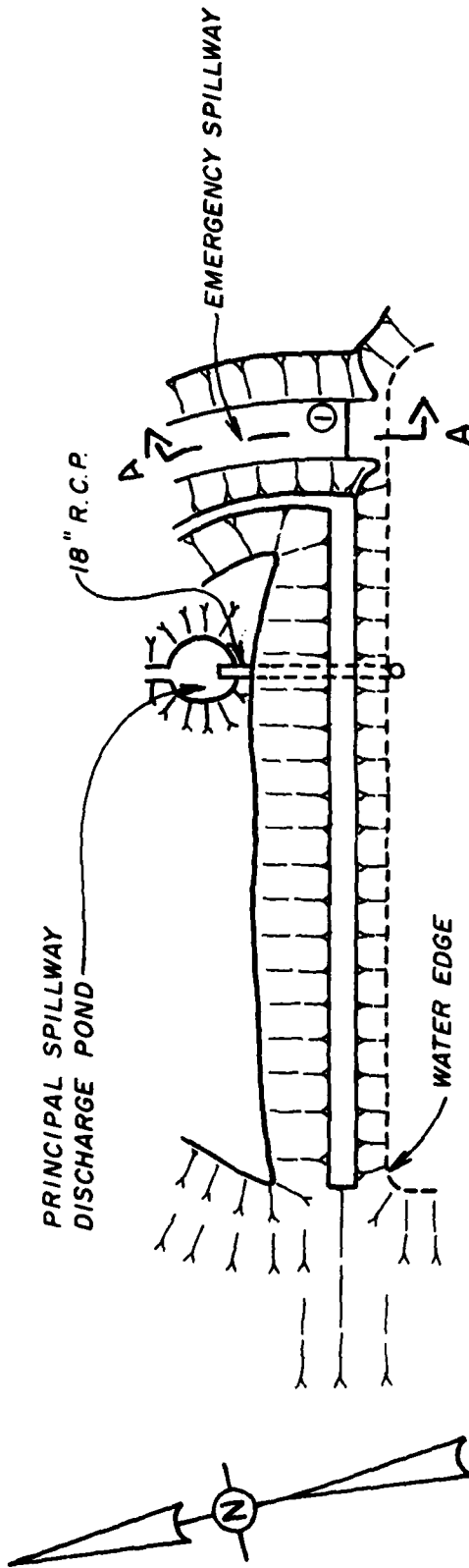


SCALE

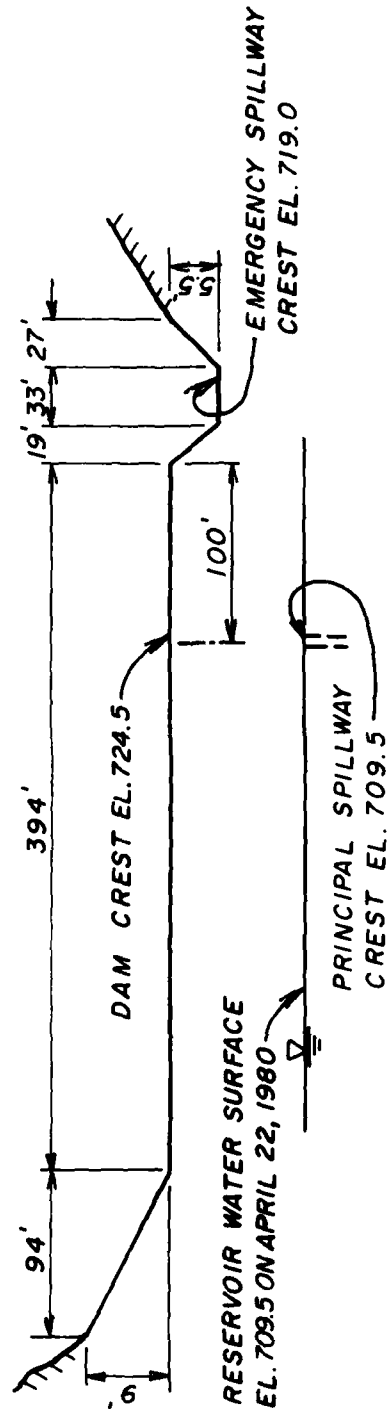


LOCATION MAP - GENTRY LAKE DAM

SCALE: 1" = 100' HORIZ
1" = 20' VERT.

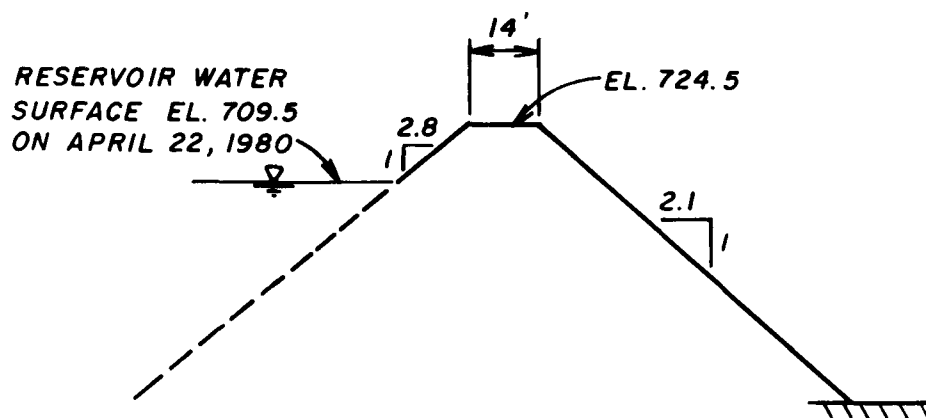


PLAN



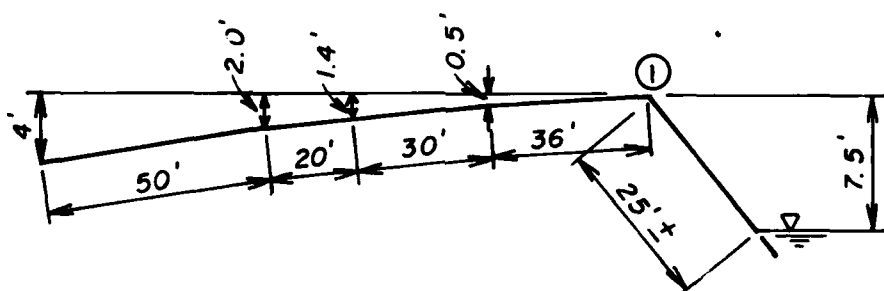
ELEVATION

GENTRY LAKE DAM
PLAN AND PROFILE



MAXIMUM SECTION

SCALE: 1" = 40' HORIZ.
1" = 20' VERT.



SPILLWAY PROFILE
SECTION A-A

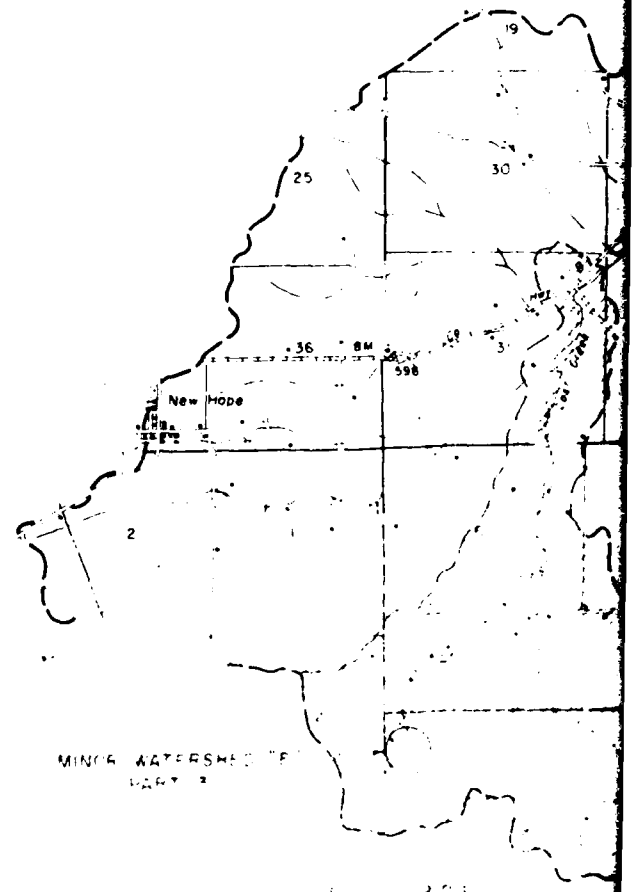
SCALE: 1" = 40' HORIZ.
1" = 10' VERT.

GENTRY LAKE DAM
SECTION OF EMBANKMENT &
SPILLWAY PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAIL PLANS
LOST CREEK WATERSHED PROJECT
THE SOIL DISTRICT OF LINCOLN COUNTY
PART 3 OF MINOR WATERSHEDS

N



APPROVED BY

H. C. C. C.

APPROVED BY

H. C. C. C.

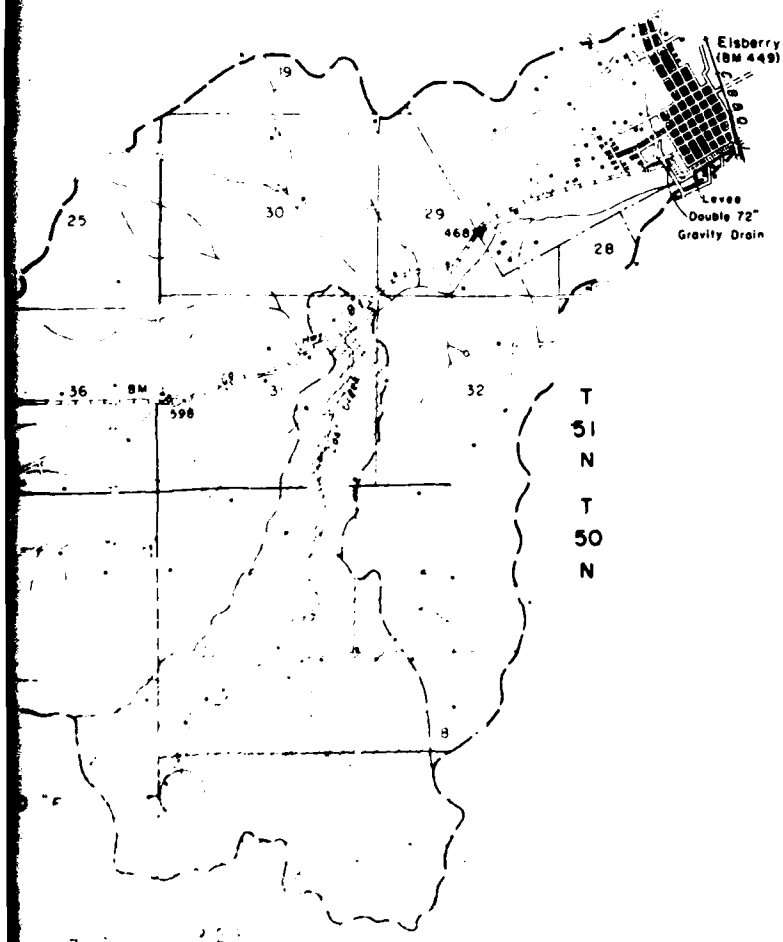
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAIL PLANS FOR WATERSHED PROTECTION PROJECT

WATER DISTRICT OF LINCOLN COUNTY, MISSOURI

OF MINOR WATERSHED "E"



LOCATION IN MISSOURI

As built - 74

3-E-45020-P
Sheet 1 of 11

State Line	---
County Line	---
Township Line	---
Section Line	---
Property Line	---
Paved Road	==
Improved Road	==
Dirt Road	---
Private or Field Road	---
Railroad	---> Active <---> Abandoned
Base Line	---
Offset Line	---
Center Line of Improvements	---
Watershed Boundary	---
Sub-Watershed Boundary	---
Fence	x x
Fence to be Removed	x x
Telephone Line (Location of Pole)	T T
Power Line (Location of Pole)	■ ■
Pipe Line	---
Water Pipe Line (Farm)	---
Existing Tile Line	---
Proposed Tile Line	---
Junction Box	○
Open Ditch (4' deep or over)	---
Shallow Ditch (Less than 4' deep)	---
Open Ditch to be Cleaned Out	---
Terrace, Graded	---
Terrace, Level	---
Rivers or Crossed Watercourse	---
Stream (Large)	---
Stream (Small)	---
Intermittent Stream	---
Stream Disappears on Flat	---
Stream Disappears in Sink	---
Marsh	---
Levee	---

Building	---
School	---
Church	---
Cemetery	---
Windmill	---
Well	---
Spring	---
Mine, Quarry, or Gravel Pit	---
Section Corner	---
Section Center	---
Bench Mark, Permanent	BM 70
Bench Mark, Temporary	TBM 71
Control Point, Permanent	AD
Control Point, Temporary	13
Point on Offset Line	---
Point of Intersection	---
Lake or Pond	---
Intermittent Lake or Pond	---
Soil Boring	102
Approximate Limit of Work Area	---
Fill Lines	---
Contours	---
Gully Banks	---
North Arrow	---
Drop Inlet	---
Drop Spillway	---
Box Inlet Drop Spillway	---
Box Inlet Drop Spillway with Bridge	---

* Dashed lines indicate existing contours or gully banks within areas of excavation and fill.

Chute	---
Chute with Bridge	---
Box Inlet Chute	---
Box Inlet Chute with Bridge	---
Bridge	---
Box Inlet Culvert	---
Culvert	---
Culvert Extension	---
Inlet on Culvert	---
Outlet on Culvert	---
Sod Flume	---
Terrace Outlet	---
Stock Watering System	---
Embankment Drainage System	---

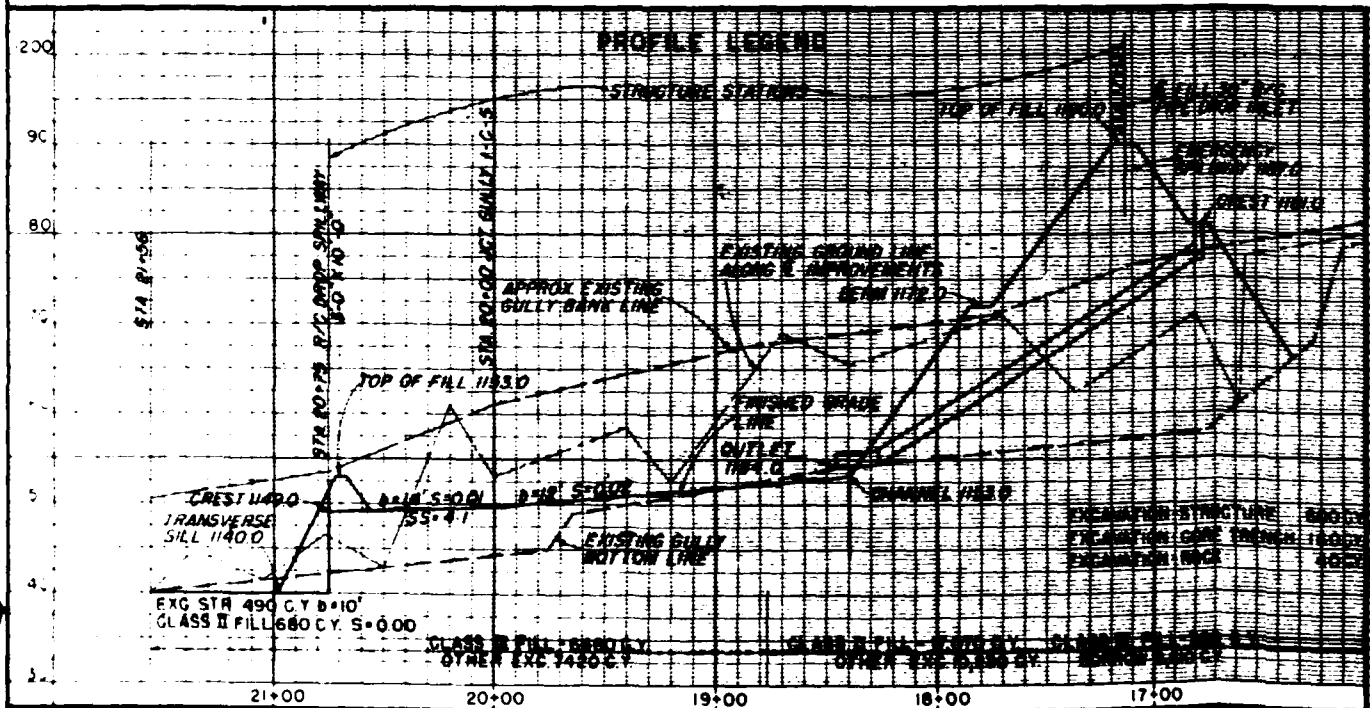
SOIL BORING

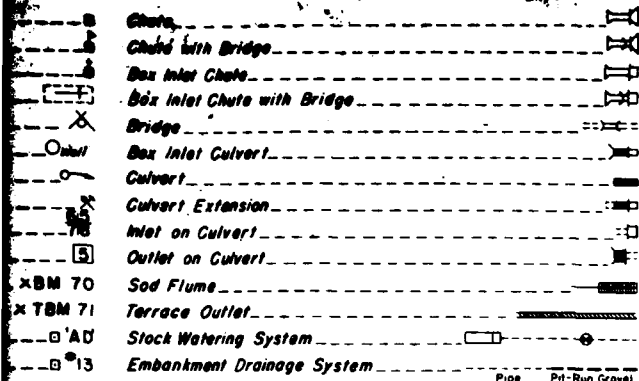
LOG

1	Muck
2	Peat
3	Silt Loam
4	Silty Clay Loam
5	Sandy Loam
6	Clay Loam
7	Sandy Clay
8	Clay
9	Sand
10	Fine Gravel
11	Coarse Gravel
12	Slate and Shale
13	Coal seam
14	Sandstone
15	Limestone
16	Glacial drift (impervious)
17	Glacial drift (pervious)

G.W. = Ground Water

NOTE: These symbols are used primarily on the Work Location Map, where applicable they may be shown on the plans.





SOIL BORINGS

LOG

METHOD No. 1

- 1
- 3
- 5
- 7
- 9

Using either the description, numerical number or symbol representing the soil type

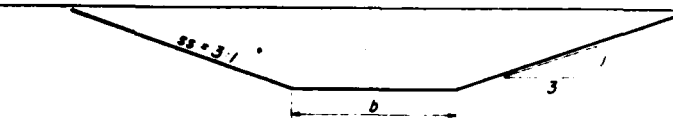
METHOD No. 2

Using Mechanical Analysis
% gravel-sand-silt-clay

- 0-18-76-6
- 0-28-64-8
- 0-20-66-14

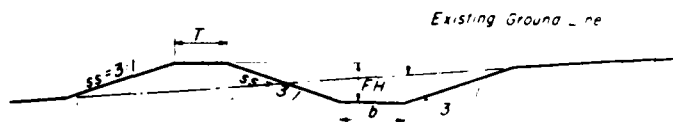
- 1 Muck
 - 2 Peat
 - 3 Silt Loam
 - 4 Silty Clay Loam
 - 5 Sandy Loam
 - 6 Clay Loam
 - 7 Sandy Clay
 - 8 Clay
 - 9 Sand
 - 10 Fine Gravel
 - 11 Coarse Gravel
 - 12 Slate and Shale
 - 13 Coal seam
 - 14 Sandstone
 - 15 Limestone
 - 16 Glacial drift (impervious)
 - 17 Glacial drift (pervious)
- G.W. = Ground Water

TYPICAL CROSS SECTIONS



IMPROVED DRAINAGEWAYS

CHANNELS, GRADED WATERCOURSES, SOD FLUMES, ETC



DIVERSIONS & EMERGENCY SPILLWAYS

DEFINITIONS OF TERMS

- s - Grade of channel in feet of drop per foot of length
- b - Bottom width of channel in feet
- ss - Side slope ratio, horizontal to vertical
- T - Top width of dike, levee or fill in feet
- FH - Fill height of dike in feet (vertical distance from bottom of channel to top of dike)

TABLE OF STANDARD DIMENSIONS

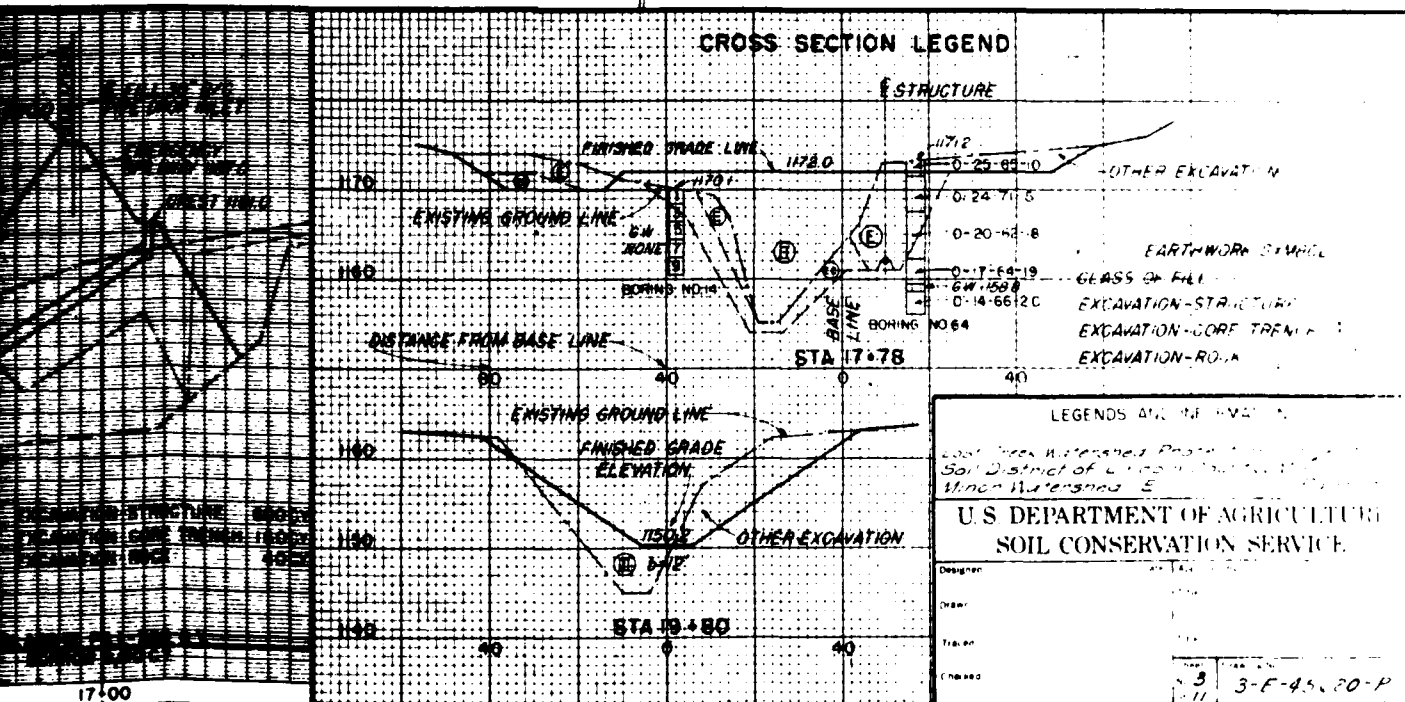
IMPROVEMENT		
Improved Drainageways	-	
Diversions	6	
Levees	6	3' or 4' slope
Drop Inlet Embankments	0	3' or 4' slope
Chute Embankments	6'	3' or 4' slope
Drop Spillway Embankments	6	3' upstream

NOTE
1. Use standard dimensions unless otherwise shown on plans.
2. Use s, b, and FH as shown on plans.

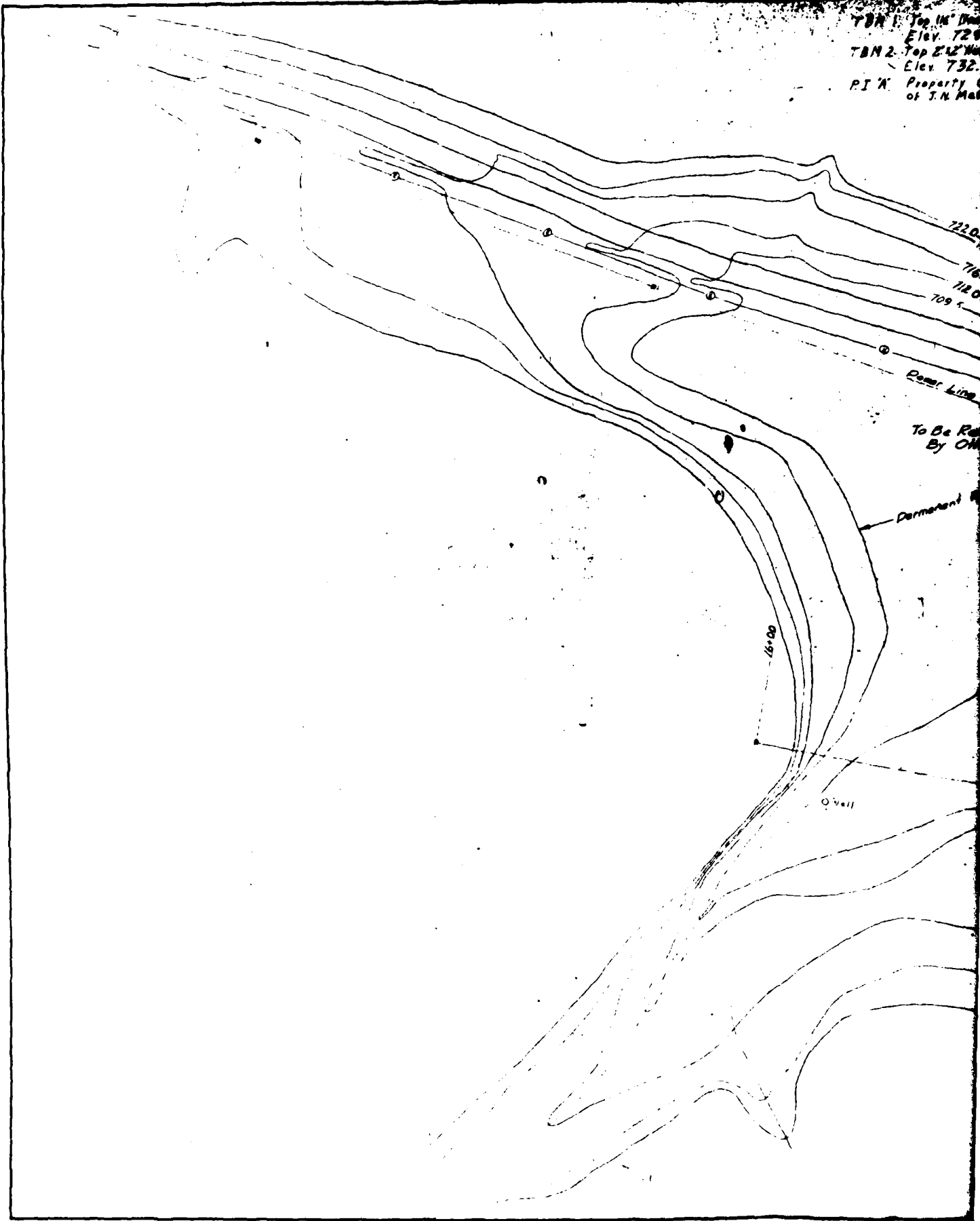
GENERAL NOTES

- Improvements are along Base Line unless otherwise indicated
- Elevations of pipes refer to invert elevations
- Cross sections shown as looking downstream
- Lines showing limits of structure excavation are on a 1:1 slope unless otherwise indicated

CROSS SECTION LEGEND



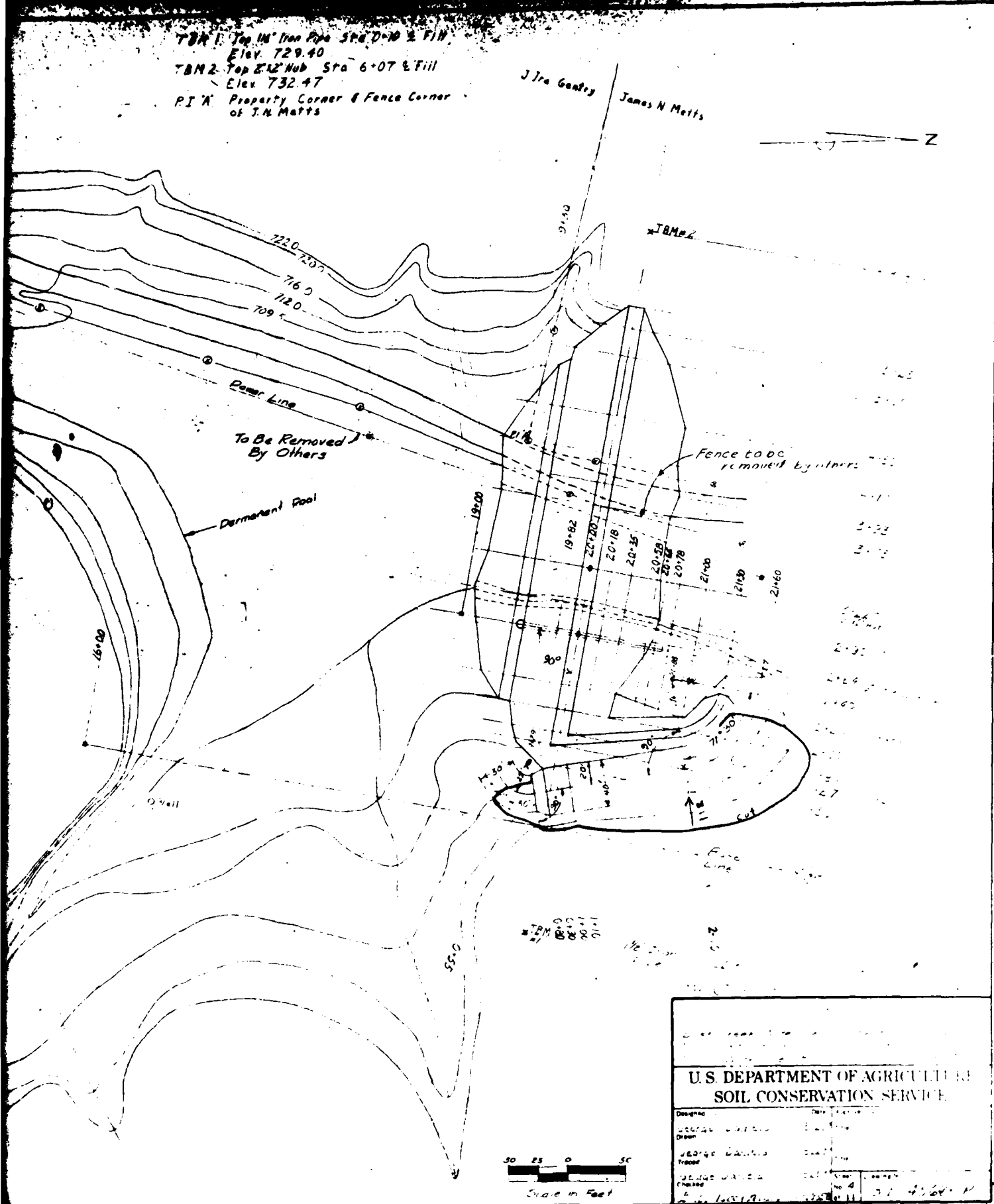
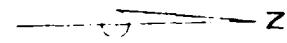
TBM 1 Top 14" Dia
Elev. 720
TBM 2 Top 24" Dia
Elev. 732
P.I.N. Property
of T.N. Map



TBM 1 Top 14" Iron Pipe Sta 6+00 & FIN
Elev 729.40
TBM 2 Top 8 1/2" Hub Sta 6+07 & Fill
Elev 732.47
PI A Property Corner & Fence Corner
of J.N. Metts

J Ira Gentry

James N Metts



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Drawn
Checked	Traced
Project	Sheet
Scale	North
Date	Drawn
By	Checked
For	Traced
Project	Sheet
Scale	North
Date	Drawn
By	Checked
For	Traced

Scale in Feet
50 25 0 25 50

18
12

J. Ira Gentry
36.4 BC

Borrow Area

Borrow Area
No. 1

Borrow Area - Nat. Limits

50' 50" W

1300' 10" 50' 4"

Note: All necessary Fence removal and/or replacement to be done by the landowners
Telephone & Power line to be moved by others (REA)

Borrow Areas - Priority of use
No. 1 - First
" " - Second

Auxiliary Borrow-Trip
Borrow Area - A minimum of two feet of top soil to be left over rock.

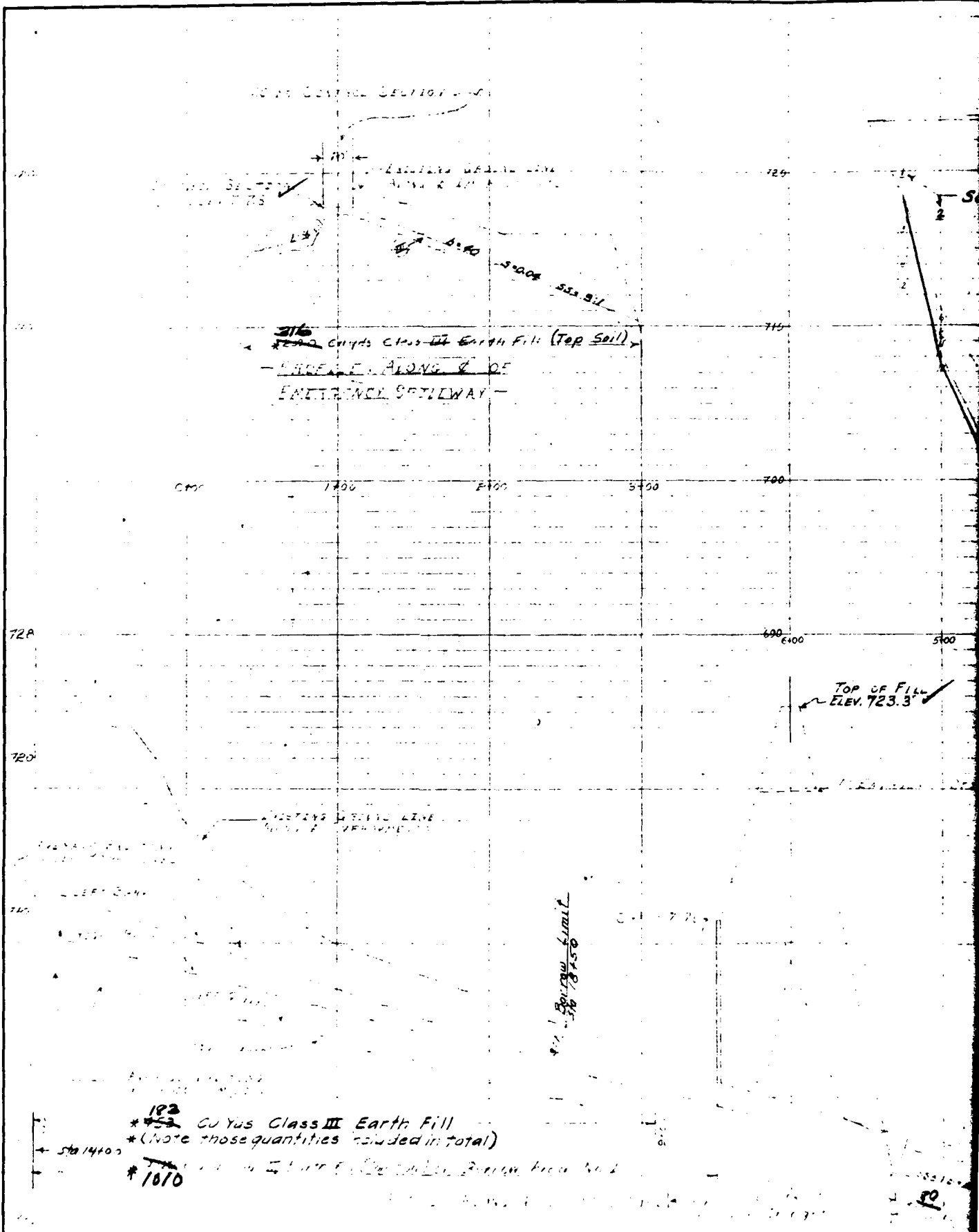
Class III Fill (top soil) to be placed to a depth of 4" over borrow area that is above elevating 7025 feet. excavation is completed. Class III Fill required is 4220 Cu. Yds based on covering the borrow area. Top soil to be secured from borrow area by the Engineer.

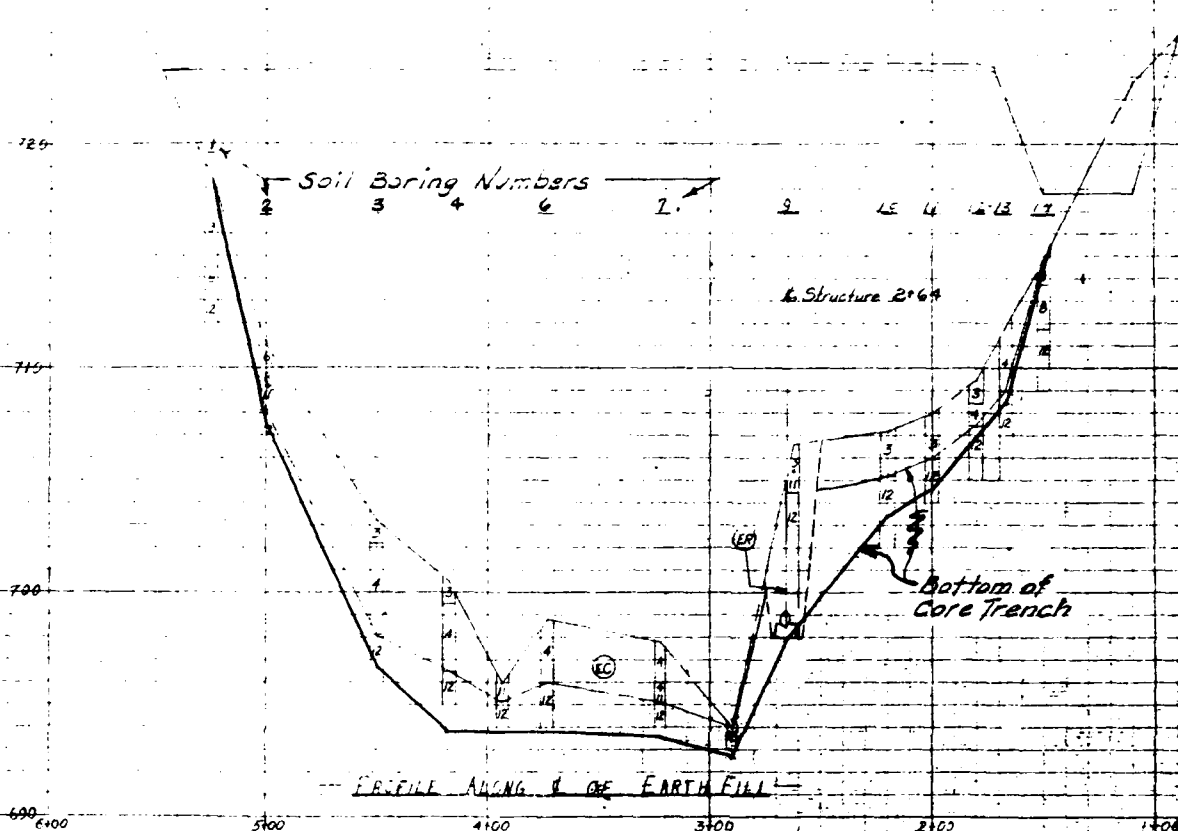
Rock to be spread below Elev. 7025 ft. by the Engineer.



6 FILL STAGG + 1 STAGG + 1 STAGG

312.00 West Creek Watershed Soil District of 21.00 Minor Watershed "E"	
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed by Drawn by Checked by Title	Date 10/17/54 10/17/54 10/17/54 10/17/54
Approved by Title Sheet No. 11	Date 10/17/54 10/17/54 10/17/54 10/17/54



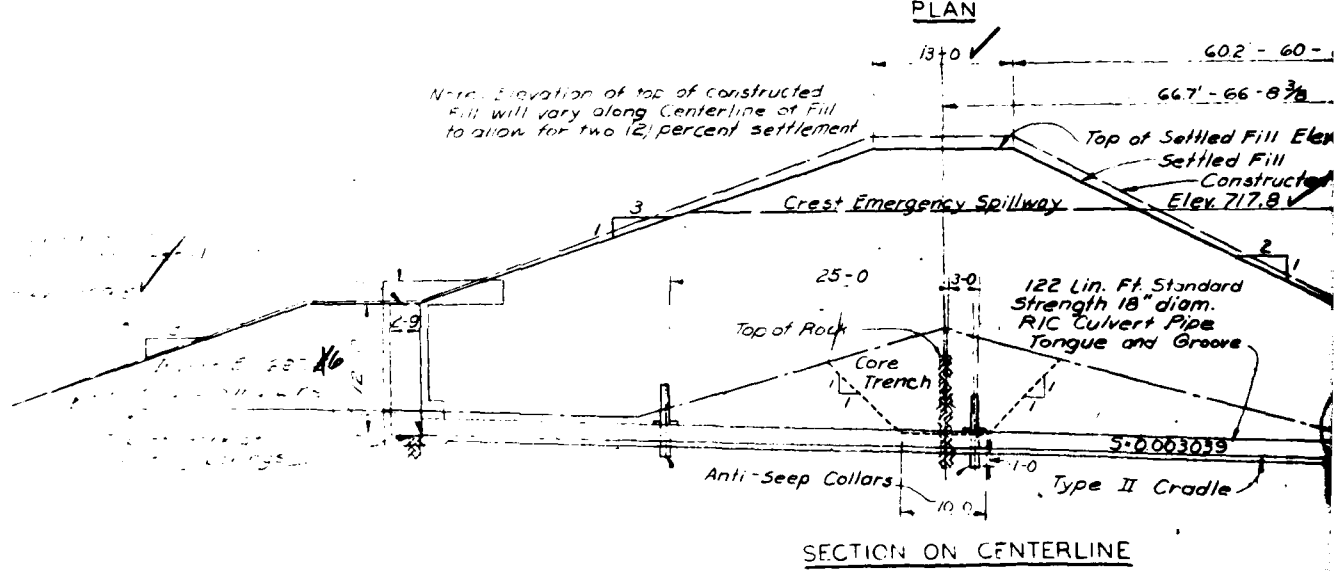
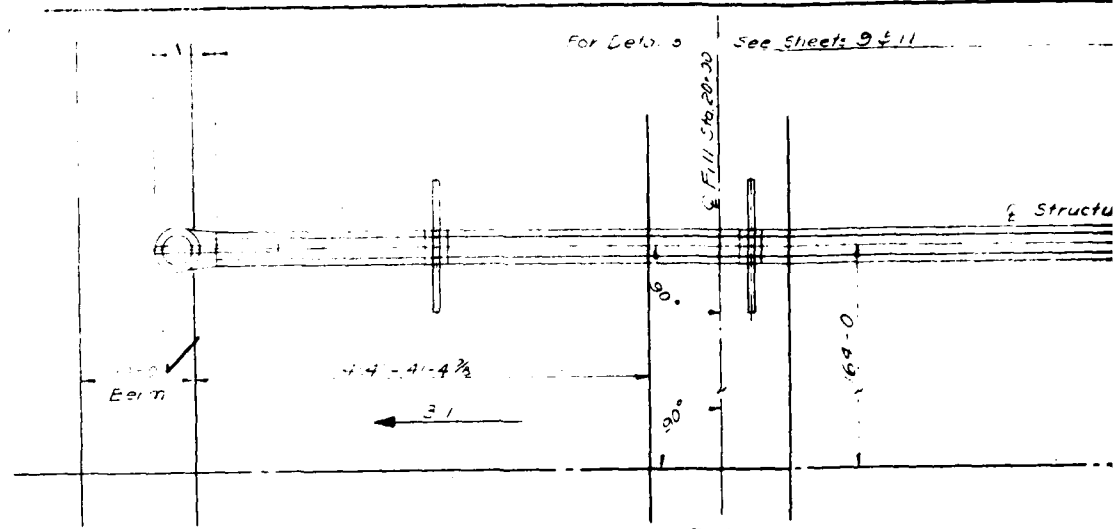


FILL AND EXCAVATION QUANTITIES

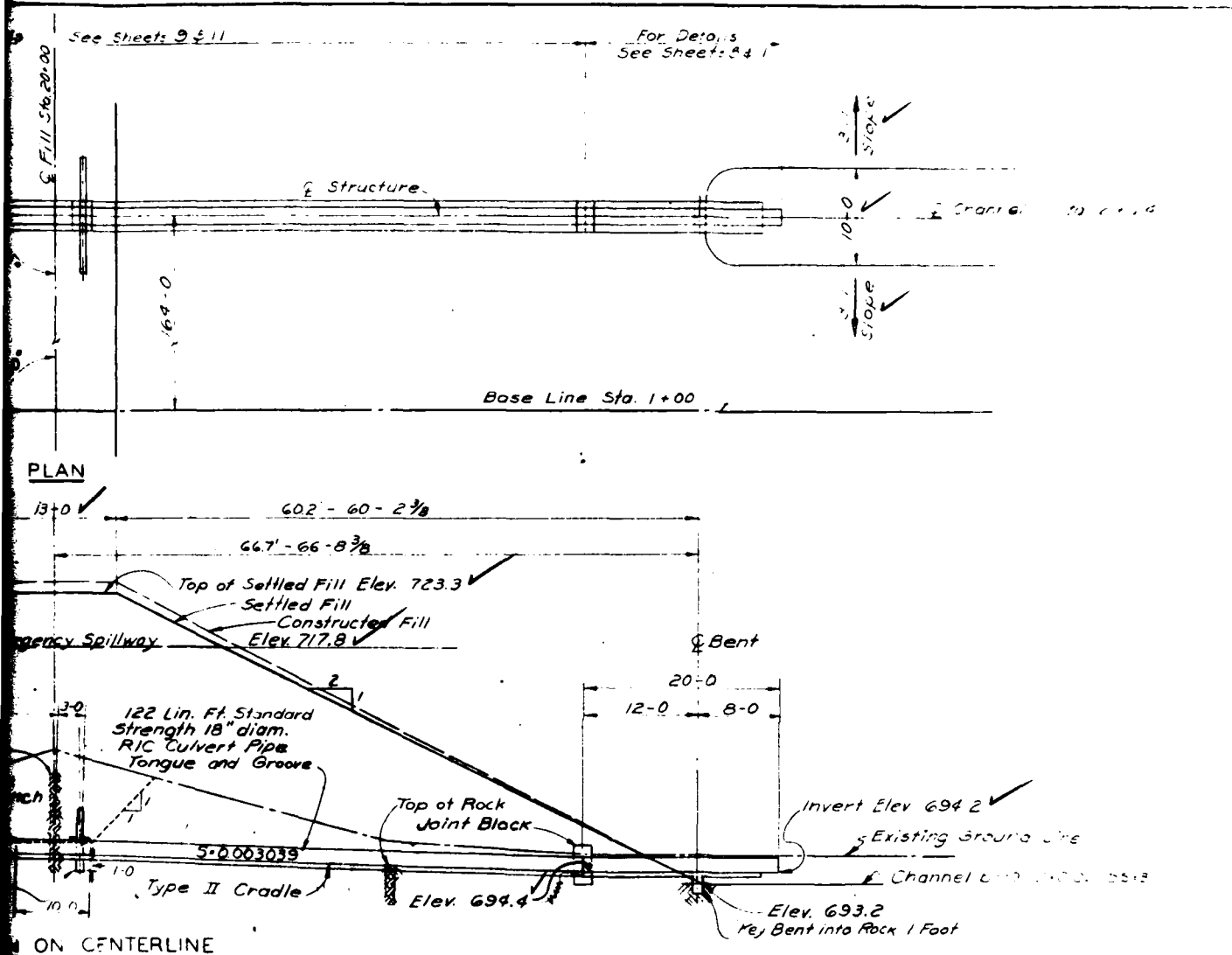
FILL			
CLASS II	22,650 Cu. Yd.	22,670 Cu. Yd.	
CLASS III	550.0 Cu. Yd.	563	
CLASS II (Top Soil)	1,000.0 Cu. Yd.	1,024	
EXCAVATION			
STRUCTURE	164.0 Cu. Yd.	220 Cu. Yd.	
CORE	440.0 Cu. Yd.	952 Cu. Yd.	
ROCK	300.0 Cu. Yd.	0	

As built ~~SAH~~
STRUCTURE E-1 E FILL STA 20+00

PROFILES	
Creek Watershed Protection Project County of Lincoln County, Missouri Part 3	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
Designed by	Approved by
Drawn	Title
Traced	Title
Checked	Sheet
	No. 6
	3-E-45620-P



Reinforced Concrete
Reinforcing Steel
Spillway, Reinforced Concrete
Standard Strength tongue
Guard Rail



QUANTITIES

Reinforced Concrete	21.96 Cu Yds
Reinforcing Steel	1033.7 Pound
Spillway, Reinforced Concrete Culvert Pipe 18" diam	1043.7 LBS.
Standard Strength tongue and groove	122.0 Lin Ft
Guard Rail	Part Job

SCALE: 1/8" = 1'-0"

STRUCTURE E-1 & FILL STA. 1+00
 R/C DROP INLET FOR 18" DIA. PIPE
 GENERAL LAYOUT
 Lost Creek Watershed Protection Project
 Soil District of Lincoln County, Missouri
 MINOR WATERSHED E PART 3
 U.S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE

By: B.G. Browning
 Geo. Daniels
 H. N. Lusby
 R. Kueter 3-27-58

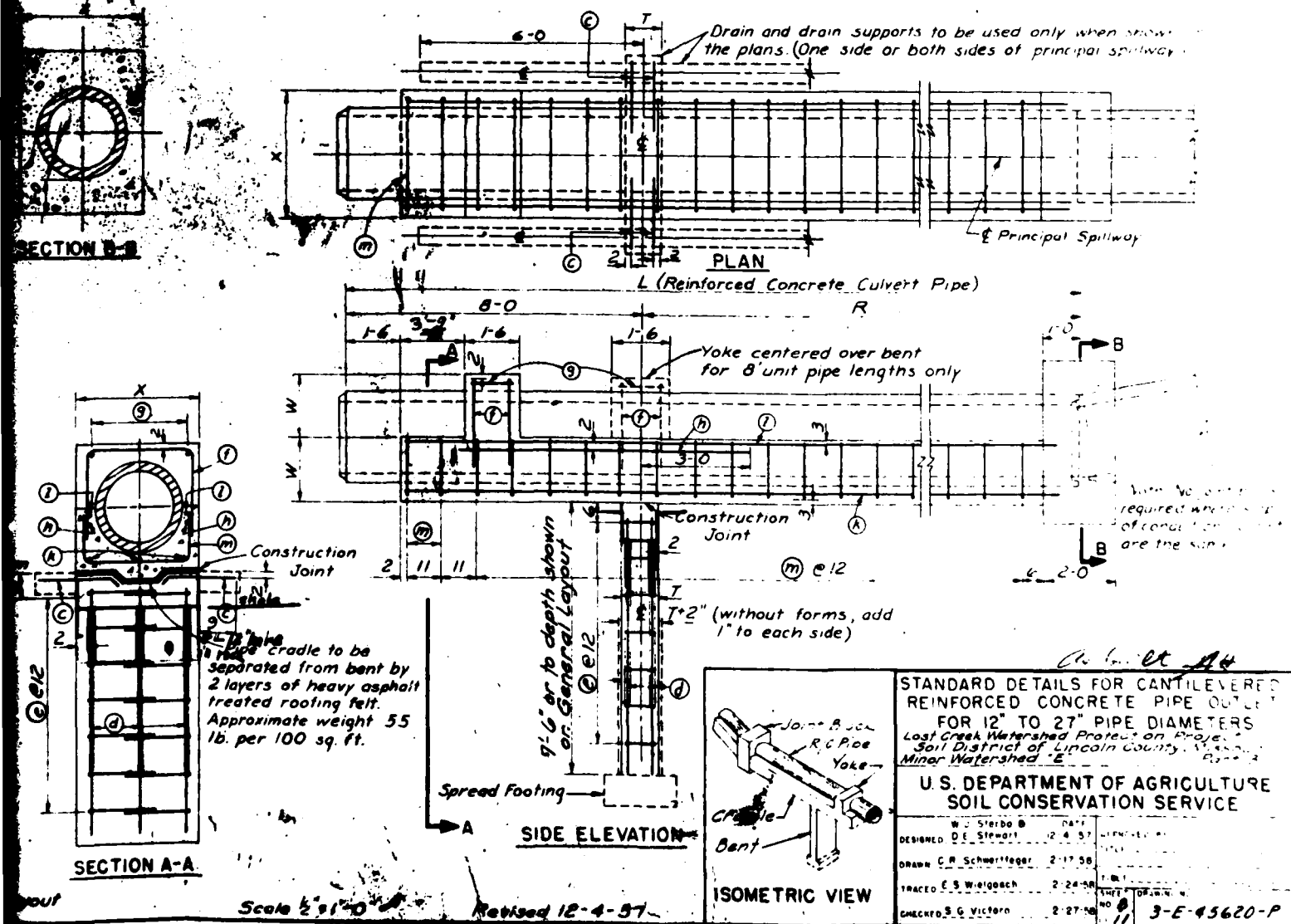
Checked: J.A. Storch

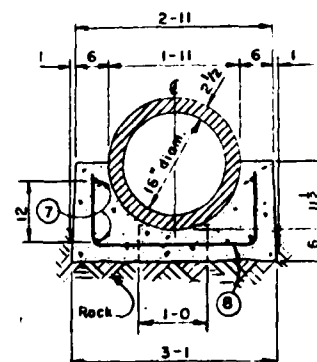
4-17-58 7 3-E-45620-P

	12'	15'	18'	21'	24'	27'
12"	0.24	0.24	0.24	0.24	0.24	0.24
18"	0.36	0.36	0.36	0.36	0.36	0.36
24"	0.48	0.48	0.48	0.48	0.48	0.48
30"	0.60	0.60	0.60	0.60	0.60	0.60
36"	0.72	0.72	0.72	0.72	0.72	0.72
42"	0.84	0.84	0.84	0.84	0.84	0.84
48"	0.96	0.96	0.96	0.96	0.96	0.96
54"	1.08	1.08	1.08	1.08	1.08	1.08
60"	1.20	1.20	1.20	1.20	1.20	1.20
66"	1.32	1.32	1.32	1.32	1.32	1.32
72"	1.44	1.44	1.44	1.44	1.44	1.44
78"	1.56	1.56	1.56	1.56	1.56	1.56
84"	1.68	1.68	1.68	1.68	1.68	1.68
90"	1.80	1.80	1.80	1.80	1.80	1.80
96"	1.92	1.92	1.92	1.92	1.92	1.92
102"	2.04	2.04	2.04	2.04	2.04	2.04
108"	2.16	2.16	2.16	2.16	2.16	2.16
114"	2.28	2.28	2.28	2.28	2.28	2.28
120"	2.40	2.40	2.40	2.40	2.40	2.40
126"	2.52	2.52	2.52	2.52	2.52	2.52
132"	2.64	2.64	2.64	2.64	2.64	2.64
138"	2.76	2.76	2.76	2.76	2.76	2.76
144"	2.88	2.88	2.88	2.88	2.88	2.88
150"	3.00	3.00	3.00	3.00	3.00	3.00
156"	3.12	3.12	3.12	3.12	3.12	3.12
162"	3.24	3.24	3.24	3.24	3.24	3.24
168"	3.36	3.36	3.36	3.36	3.36	3.36
174"	3.48	3.48	3.48	3.48	3.48	3.48
180"	3.60	3.60	3.60	3.60	3.60	3.60
186"	3.72	3.72	3.72	3.72	3.72	3.72
192"	3.84	3.84	3.84	3.84	3.84	3.84
198"	3.96	3.96	3.96	3.96	3.96	3.96
204"	4.08	4.08	4.08	4.08	4.08	4.08
210"	4.20	4.20	4.20	4.20	4.20	4.20
216"	4.32	4.32	4.32	4.32	4.32	4.32
222"	4.44	4.44	4.44	4.44	4.44	4.44
228"	4.56	4.56	4.56	4.56	4.56	4.56
234"	4.68	4.68	4.68	4.68	4.68	4.68
240"	4.80	4.80	4.80	4.80	4.80	4.80
246"	4.92	4.92	4.92	4.92	4.92	4.92
252"	5.04	5.04	5.04	5.04	5.04	5.04
258"	5.16	5.16	5.16	5.16	5.16	5.16
264"	5.28	5.28	5.28	5.28	5.28	5.28
270"	5.40	5.40	5.40	5.40	5.40	5.40
276"	5.52	5.52	5.52	5.52	5.52	5.52
282"	5.64	5.64	5.64	5.64	5.64	5.64
288"	5.76	5.76	5.76	5.76	5.76	5.76
294"	5.88	5.88	5.88	5.88	5.88	5.88
300"	6.00	6.00	6.00	6.00	6.00	6.00
306"	6.12	6.12	6.12	6.12	6.12	6.12
312"	6.24	6.24	6.24	6.24	6.24	6.24
318"	6.36	6.36	6.36	6.36	6.36	6.36
324"	6.48	6.48	6.48	6.48	6.48	6.48
330"	6.60	6.60	6.60	6.60	6.60	6.60
336"	6.72	6.72	6.72	6.72	6.72	6.72
342"	6.84	6.84	6.84	6.84	6.84	6.84
348"	6.96	6.96	6.96	6.96	6.96	6.96
354"	7.08	7.08	7.08	7.08	7.08	7.08
360"	7.20	7.20	7.20	7.20	7.20	7.20
366"	7.32	7.32	7.32	7.32	7.32	7.32
372"	7.44	7.44	7.44	7.44	7.44	7.44
378"	7.56	7.56	7.56	7.56	7.56	7.56
384"	7.68	7.68	7.68	7.68	7.68	7.68
390"	7.80	7.80	7.80	7.80	7.80	7.80
396"	7.92	7.92	7.92	7.92	7.92	7.92
402"	8.04	8.04	8.04	8.04	8.04	8.04
408"	8.16	8.16	8.16	8.16	8.16	8.16
414"	8.28	8.28	8.28	8.28	8.28	8.28
420"	8.40	8.40	8.40	8.40	8.40	8.40
426"	8.52	8.52	8.52	8.52	8.52	8.52
432"	8.64	8.64	8.64	8.64	8.64	8.64
438"	8.76	8.76	8.76	8.76	8.76	8.76
444"	8.88	8.88	8.88	8.88	8.88	8.88
450"	9.00	9.00	9.00	9.00	9.00	9.00
456"	9.12	9.12	9.12	9.12	9.12	9.12
462"	9.24	9.24	9.24	9.24	9.24	9.24
468"	9.36	9.36	9.36	9.36	9.36	9.36
474"	9.48	9.48	9.48	9.48	9.48	9.48
480"	9.60	9.60	9.60	9.60	9.60	9.60
486"	9.72	9.72	9.72	9.72	9.72	9.72
492"	9.84	9.84	9.84	9.84	9.84	9.84
498"	9.96	9.96	9.96	9.96	9.96	9.96
504"	10.08	10.08	10.08	10.08	10.08	10.08
510"	10.20	10.20	10.20	10.20	10.20	10.20
516"	10.32	10.32	10.32	10.32	10.32	10.32
522"	10.44	10.44	10.44	10.44	10.44	10.44
528"	10.56	10.56	10.56	10.56	10.56	10.56
534"	10.68	10.68	10.68	10.68	10.68	10.68
540"	10.80	10.80	10.80	10.80	10.80	10.80
546"	10.92	10.92	10.92	10.92	10.92	10.92
552"	11.04	11.04	11.04	11.04	11.04	11.04
558"	11.16	11.16	11.16	11.16	11.16	11.16
564"	11.28	11.28	11.28	11.28	11.28	11.28
570"	11.40	11.40	11.40	11.40	11.40	11.40
576"	11.52	11.52	11.52	11.52	11.52	11.52
582"	11.64	11.64	11.64	11.64	11.64	11.64
588"	11.76	11.76	11.76	11.76	11.76	11.76
594"	11.88	11.88	11.88	11.88	11.88	11.88
600"	12.00	12.00	12.00	12.00	12.00	12.00
606"	12.12	12.12	12.12	12.12	12.12	12.12
612"	12.24	12.24	12.24	12.24	12.24	12.24
618"	12.36	12.36	12.36	12.36	12.36	12.36
624"	12.48	12.48	12.48	12.48	12.48	12.48
630"	12.60	12.60	12.60	12.60	12.60	12.60
636"	12.72	12.72	12.72	12.72	12.72	12.72
642"	12.84	12.84	12.84	12.84	12.84	12.84
648"	12.96	12.96	12.96	12.96	12.96	12.96
654"	13.08	13.08	13.08	13.08	13.08	13.08
660"	13.20	13.20	13.20	13.20	13.20	13.20
666"	13.32	13.32	13.32	13.32	13.32	13.32
672"	13.44	13.44	13.44	13.44	13.44	13.44
678"	13.56	13.56	13.56	13.56	13.56	13.56
684"	13.68	13.68	13.68	13.68	13.68	13.68
690"	13.80	13.80	13.80	13.80	13.80	13.80
696"	13.92	13.92	13.92	13.92	13.92	13.92
702"	14.04	14.04	14.04	14.04	14.04	14.04
708"	14.16	14.16	14.16	14.16	14.16	14.16
714"	14.28	14.28	14.28	14.28	14.28	14.28
720"	14.40	14.40	14.40	14.40	14.40	14.40
726"	14.52	14.52	14.52	14.52	14.52	14.52
732"	14.64	14.64	14.64	14.64	14.64	14.64
738"	14.76	14.76	14.76	14.76	14.76	14.76
744"	14.88	14.88	14.88	14.88	14.88	14.88
750"	15.00	15.00	15.00	15.00	15.00	15.00
756"	15.12	15.12	15.12	15.12	15.12	15.12
762"	15.24	15.24	15.24	15.24	15.24	15.24
768"	15.36	15.36	15.36	15.36	15.36	15.36
774"	15.48	15.48	15.48	15.48	15.48	15.48
780"	15.60	15.60	15.60	15.60	15.60	15.60
786"	15.72	15.72	15.72	15.72	15.72	15.72
792"	15.84	15.84	15.84	15.84	15.84	15.84
798"	15.96	15.96	15.96	15.96	15.96	15.96
804"	16.08	16.08	16.08	16.08	16.08	16.08
810"	16.20	16.20	16.20	16.20	16.20	16.20
816"	16.32	16.32	16.32	16.32	16.32	16.32
822"	16.44	16.44	16.44	16.44	16.44	16.44
828"	16.56	16.56	16.56	16.56	16.56	16.56
834"	16.68	16.68	16.68	16.68	16.68	16.68
840"	16.80	16.80	16.80	16.80	16.80	16.80
846"	16.92	16.92	16.92	16.92	16.92	16.92
852"	17.04	17.04	17.04	17.04	17.04	17.04
858"	17.16	17.16	17.16	17.16	17.16	17.16
864"	17.28	17.28	17.28	17.28	17.28	17.28
870"	17.40	17.40	17.40	17.40	17.40	17.40
876"	17.52	17.52	17.52	17.52	17.52	17.52
882"	17.64	17.64	17.64	17.64	17.64	17.64
888"	17.76	17.76	17.76	17.76	17.76	17.76
894"	17.88	17.88	17.88	17.88	17.88	17.88
900"	18.00	18.00	18.00	18.00	18.00	18.00
906"	18.12	18.12	18.12	18.12	18.12	18.12
912"	18.24	18.24	18.24	18.24	18.24	18.24
918"	18.36	18.36	18.36	18.36	18.36	18.36
924"	18.48	18.48	18.48	18.48	18.48	18.48
930"	18.60	18.60	18.60	18.60	18.60	18.60
936"	18.72	18.72	18.72	18.72	18.72	18.72
942"	18.84	18.84	18.84	18.84	18.84	18.84
948"	18.96	18.96	18.96	18.96	18.96	18.96
954"	19.08	19.08	19.08	19.08	19.08	19.08
960"	19.20	19.20	19.20	19.20	19.20	19.20
966"	19.32	19.32	19.32	19.32	19.32	19.32
972"	19.44	19.44	19.44	19.44	19.44	19.44
978"	19.56	19.56	19.56	19.56	19.56	19.56
984"	19.68	19.68	19.68	19.68	19.68	19.68
990"	19.80	19.80	19.80	19.80	19.80	19.80
996"	19.92	19.92	19.92	19.92	19.92	19.92
1002"	20.04	20.04	20.04	20.04	20.04	20.04
1008"	20.16	20.16	20.16	20.16	20.16	20.16
1014"	20.28	20.28	20.28	20.28	20.28	20.28
1020"	20.40	20.40	20.40	20.40	20.40	20.40
1026"	20.52	20.52	20.52	20.52	20.52	20.52
1032"	20.64	20.64	20.64	20.64	20.64	20.64
1038"	20.76	20.76	20.76	20.76	20.76	20.76
1044"	20.88	20.88	20.88	20.88	20.88	20.88

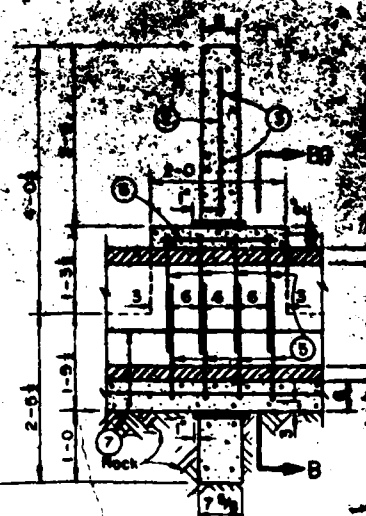
STEEL SCHEDULE

SPEED SCHEDULE																																							
16" Diameter										18" Diameter										21" Diameter										24" Diameter									
Mark	Type	Size	Quan	Length	A	B	C	Total Length	A	B	C	Total Length	A	B	C	Total Length	A	B	C	Total Length																			
Schedule to be used for both L = 20'-0" and L = 24'-0"																																							
ent	a	3	4	6	2'-0	0-9	1-9	15-0	2-9	0-10	1-11	16'-6	3-0	1-0	2-0	6'-0	3-0	1-0	2-0	6'-0																			
	b	1	4	3	1-9			5-3	2-0			6'-0	2-9			8'-9	3-0			9'-0																			
(each)	c	1	4	2	2-0			4-0	2-0			4'-0	2-0			4'-0	2-0			4'-0																			
	d	1	4	6	7-0			42-0	7-0			42-0	7-0			42-0	7-0			42-0																			
	e	4	3	14	3-3	1-5	0-5	11-5	45-6	4-0	1-9	0-6	1-9	56-0	4-6	1-11	0-8	1-11	63-0	4-9	2-0																		
	f	4	4	2	5-0	1-6	1-11	1-6	10-0	5-9	1-9	2-2	1-9	11-6	7-9	2-6	2-9	2-6	15-6	8-6	2-9																		
	g	1	3	2	1-0			2-0	1-0			2-0	1-0			2-0	1-0			2-0	1-0																		
	h	1	5	2	8-0			16-0	8-0			16-0	8-0			16-0	8-0			16-0	8-0																		
		1	6	2																	8-0																		
Additional Schedule to be used for L = 20'-0" only																																							
	k	1	4	3	18-0			54-0	18-0			54-0	18-0			54-0	18-0			54-0	18-0																		
	l	1	5	2	18-0			36-0	18-0			36-0	18-0			36-0	18-0			36-0	18-0																		
	m	4	4	18	3-0	0-6	1-11	0-6	54-0	3-6	0-8	2-2	0-8	63-0	4-9	1-0	2-9	1-0	85-6	5-3	1-1/2																		
Additional Schedule to be used for L = 24'-0" only																																							
	k	1	4	3	22-0			66-0	22-0			66-0	22-0			66-0	22-0			66-0	22-0																		
	l	1	5	2	22-0			44-0	22-0			44-0	22-0			44-0	22-0			44-0	22-0																		
	m	4	4	22	3-0	0-6	1-11	0-6	66-0	3-6	0-8	2-2	0-8	77-0	4-9	1-0	2-9	1-0	105-3	5-3	1-1/2																		





SECTION A-A

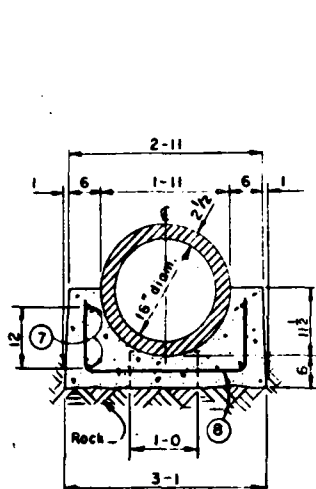


SECTION ON G

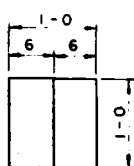
Shown with Type II Cordle

As Constructed

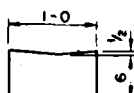
STEP SCHEDULE									
ANTI-SEEP COLLAR (FOR TYPE I PIPE)									
Location	Mark	Size	Length	Quantity	Type	Material	Notes	Remarks	
Collar	1	4	6	6	C				
	2		2	3					
	3		3	11	K				
	4		6	4	C				
	5		9	6	O				
	6		2	1	9				
TYPE II CRADLE (PER FT. OF CRADLE)									
	7								
	8			4	9				



SECTION A-A



PLAN



FRONT ELEVATION

DETAILS OF PRECAST CONCRETE BLOCK

NOTE: Concrete building block or brick may be provided in lieu of precast concrete block as shown.
(Scale 1" = 1'-0")

QUANTITIES

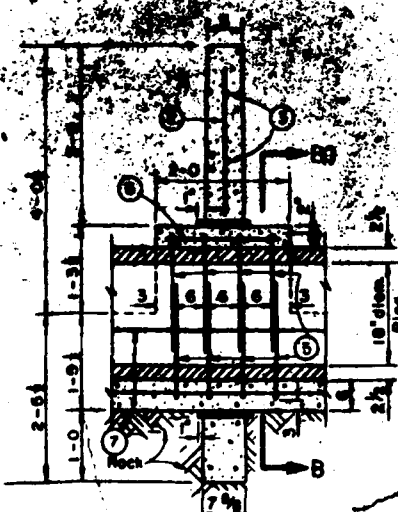
Reinforced Concrete _____
Steel #4 bars _____ (67.00 lb. in ft.) _____
(For One (1) Anti-Seep Collar per ft.)

By Contract Modification #1

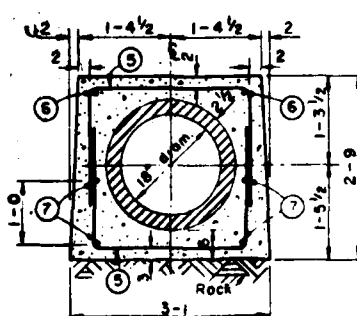
3 - Expansion Joints

R/C
Steel

95 Cyls. total
10. Pounds ✓



SECTION ON C
Shown with Type II Cradle



SECTION B-B
With Type II Cradle

STRUCTURE E-1 (ELEV. 574.0)

DETAILS OF ANTI-SEEP COLLAR FOR 18" PIPE

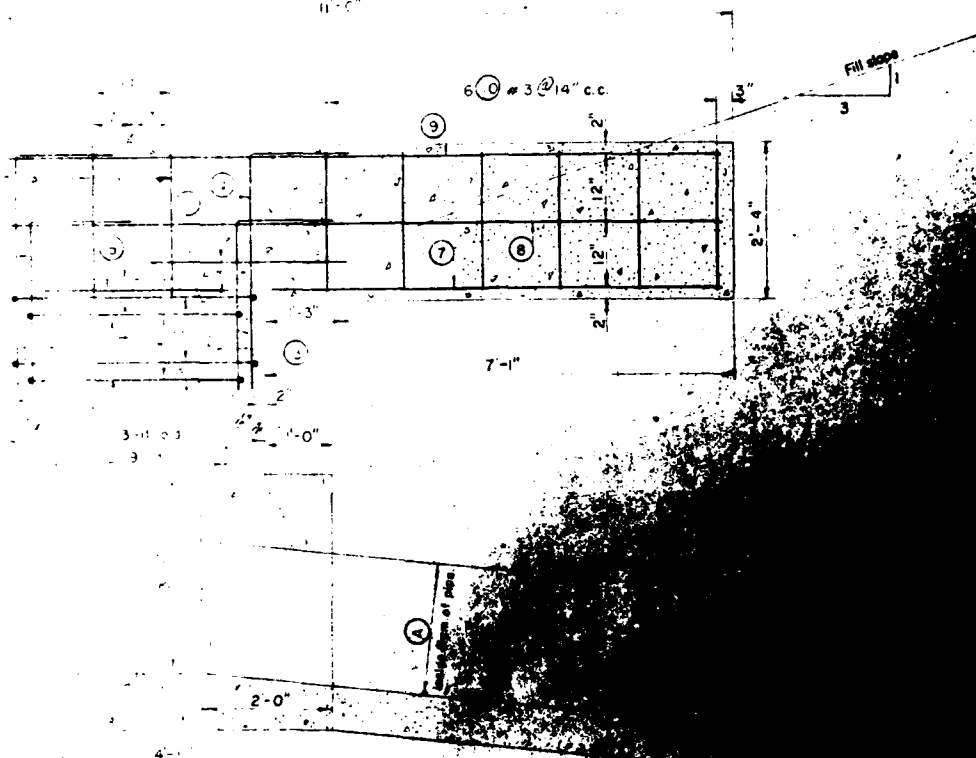
Lost Creek Watershed Protection Project
Soil District of Lincoln County, Missouri
Minor Watershed, E. Part 3

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

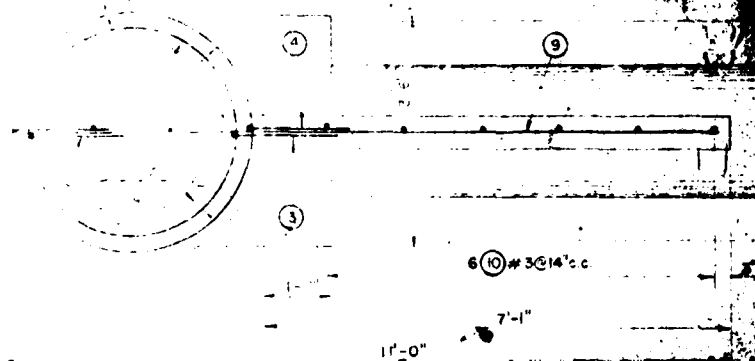
H. Luedcke 3-26-54
R. Kuster 4-1-56

D. J. Neubauer 4-8-59 3-E-45620-P

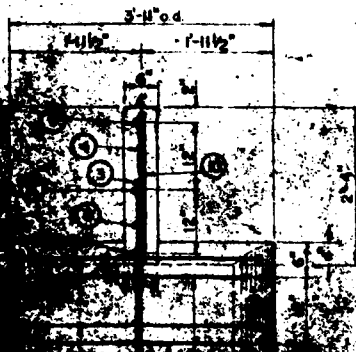
Scale 3/4" = 1'-0" unless shown



SECTION ON CENTERLINE



PLAN



STEEL SCHEDULE					
LOCATION	MARK	SIZE	AMT	TH	WT
Riser	1	#2	2	9	
	2		2	2	
Riser-Bafflewall	3	#5	2	4	
	4		2	5	
Bafflewall	5	#4	1	3	
	6	#5	1	3	
	7	#4	1	6	
	8			10	
	9	#5	1	10	
	10	#3	2	2	

QUANTITIES

#2	45.5
#3	16.00
#4	20.50
#5	31.75

Linear Feet

Total

BAR TYPE DETAILS

Straight

TYPE-1

2" radius

TYPE-2

Notes:
1. All dimensions are given in feet and inches.
2. All dimensions are rounded to the nearest 1/4 inch.
3. All dimensions are given to the center of the structure.
4. All dimensions are given to the outside of the structure.

TABLE SHOWING DIMENSION & MATERIALS

MARK	SIZE	AMT	TH	WT
1	#2	2	9	
2		2	2	
3	#5	2	4	
4		2	5	
5	#4	1	3	
6	#5	1	3	
7	#4	1	6	
8			10	
9	#5	1	10	
10	#3	2	2	

DIMENSIONS

MATERIAL

QUANTITY

Volume of Concrete in Cu Yds. 3.90

As Constructed
FILL STANDARD

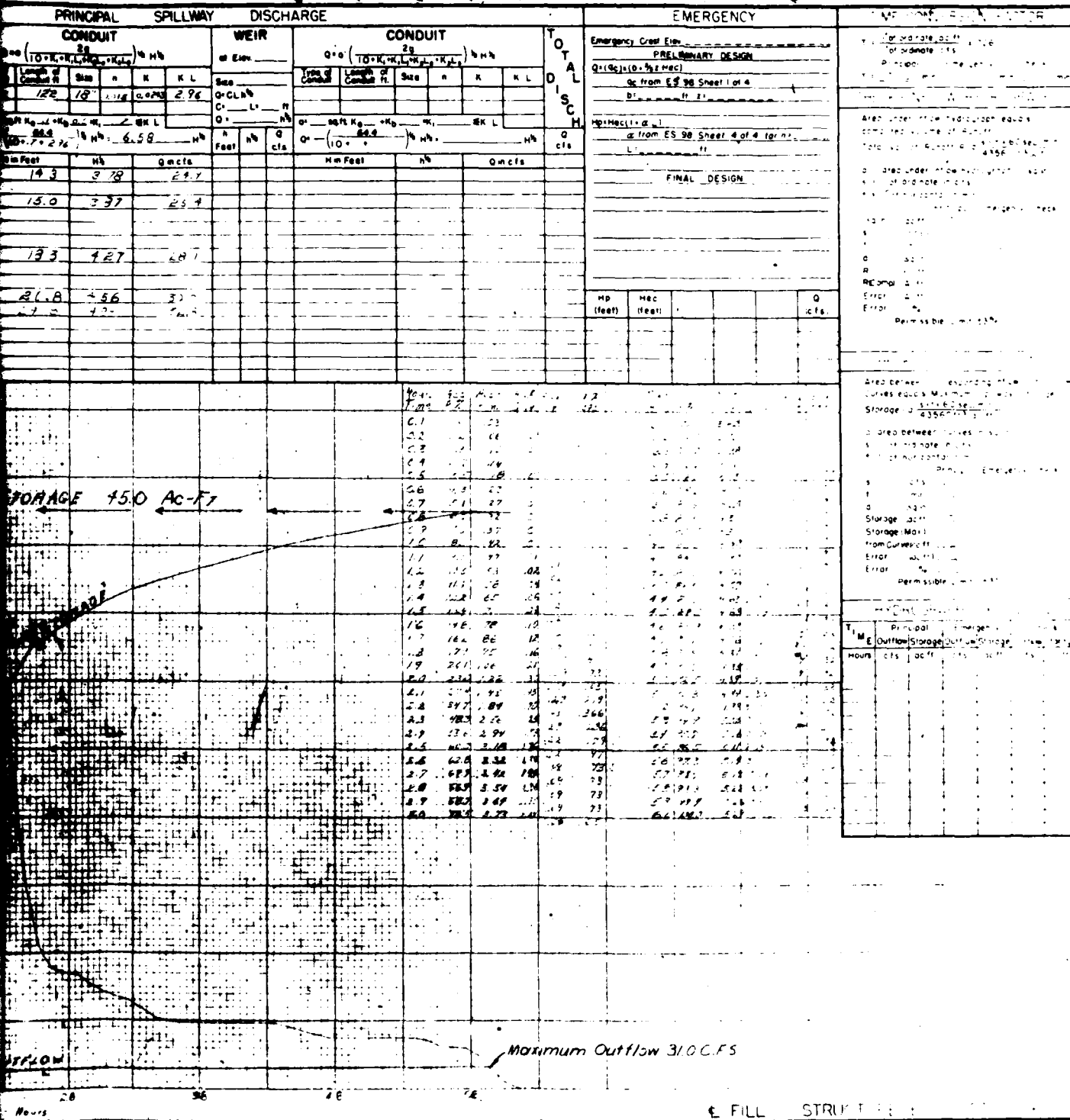
CONCRETE CIRCULAR RISER WITH

Lost Creek Watershed
Soil District of Lincoln
Minor Watershed 12

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DESIGNED BY: W. H. Luebke
DATE: 8-27-58
SHEET: 10
TITLE: 3-E-45620-P

STANDARD DESIGN NO. 37504



HYDROGRAPH DEVELOPMENT FOR EMERGENCY SPILLWAY DESIGN				CHECK HYDROGRAPH FOR HIGH HAZARD DESIGN				SUMMARY DATA			
Time (hr)	Discharge (cfs)	Storage (ac-ft)	Peak Rate of Inflow (cfs)	Maximum Discharge (cfs)	Maximum Storage (ac-ft)	Available Sediment Storage (ac-ft)	Conduit Size (ft)	River Size (ft)	Orifice (ft)	Emergency Spillway (cfs)	Principal Spillway (cfs)
0	0	0	0	0	0	0	0	0	0	0	0
1	100	100	100	100	100	100	100	100	100	100	100
2	200	200	200	200	200	200	200	200	200	200	200
3	300	300	300	300	300	300	300	300	300	300	300
4	400	400	400	400	400	400	400	400	400	400	400
5	500	500	500	500	500	500	500	500	500	500	500
6	600	600	600	600	600	600	600	600	600	600	600
7	700	700	700	700	700	700	700	700	700	700	700
8	800	800	800	800	800	800	800	800	800	800	800
9	900	900	900	900	900	900	900	900	900	900	900
10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
11	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
12	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
13	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
14	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
15	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
16	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
17	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
18	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
19	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
20	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
21	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
22	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
23	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
24	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
25	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
26	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600
27	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700
28	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800
29	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
30	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
31	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100
32	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000
33	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
34	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800	2800
35	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700
36	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600	2600
37	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500	2500
38	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400	2400
39	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
40	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
41	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
42	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
43	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
44	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
45	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
46	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
47	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
48	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
49	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
50	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
51	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100
52	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
53	900	900	900	900	900	900	900	900	900	900	900
54	800	800	800	800	800	800	800	800	800	800	800
55	700	700	700	700	700	700	700	700	700	700	700
56	600	600	600	600	600	600	600	600	600	600	600
57	500	500	500	500	500	500	500	500	500	500	500
58	400	400	400	400	400	400	400	400	400	400	400
59	300	300	300	300	300	300	300	300	300	300	300
60	200	200	200	200	200	200	200	200	200	200	200
61	100	100	100	100	100	100	100	100	100	100	100
62	0	0	0	0	0	0	0	0	0	0	0

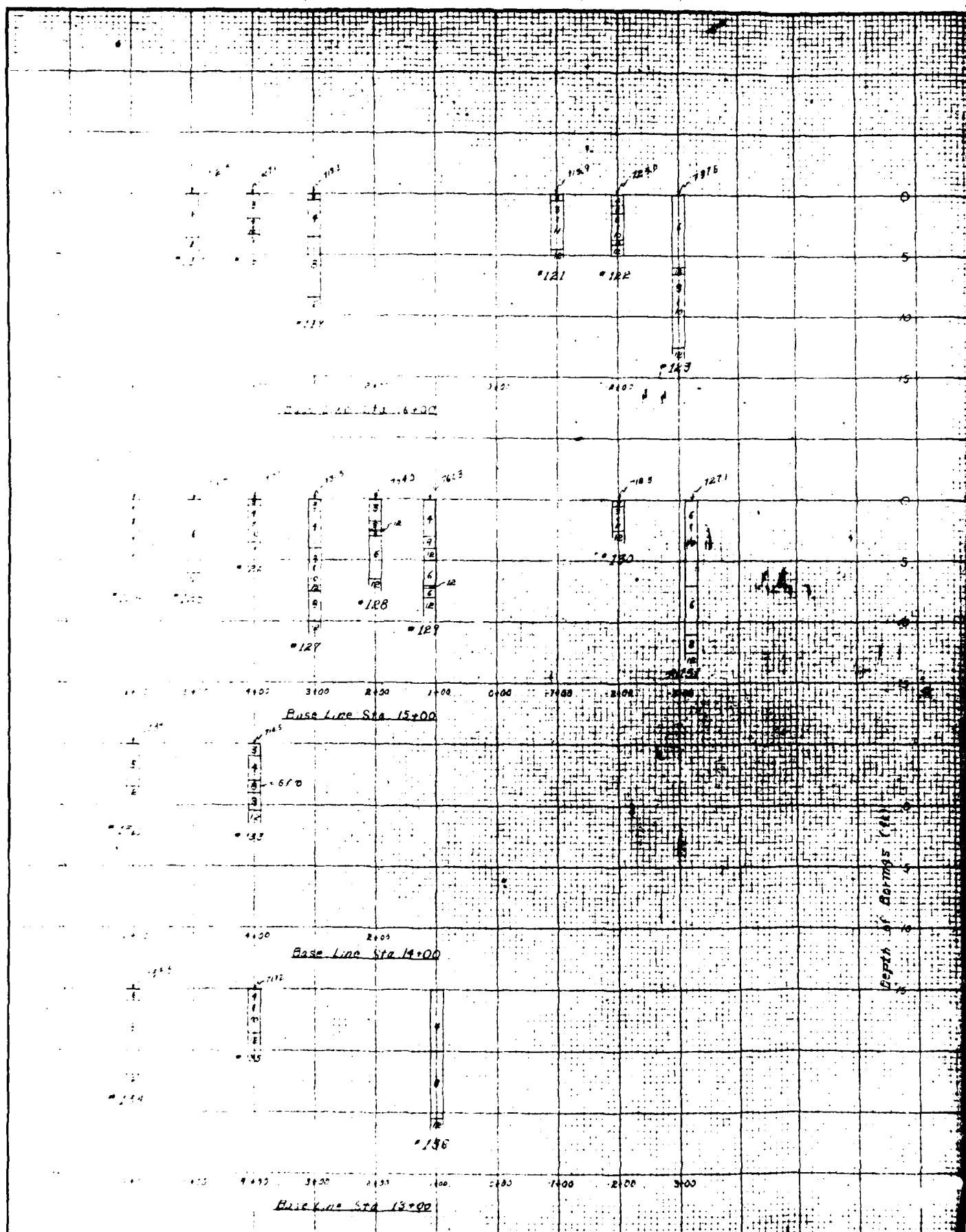
FLOOD ROUTING SPILLWAY

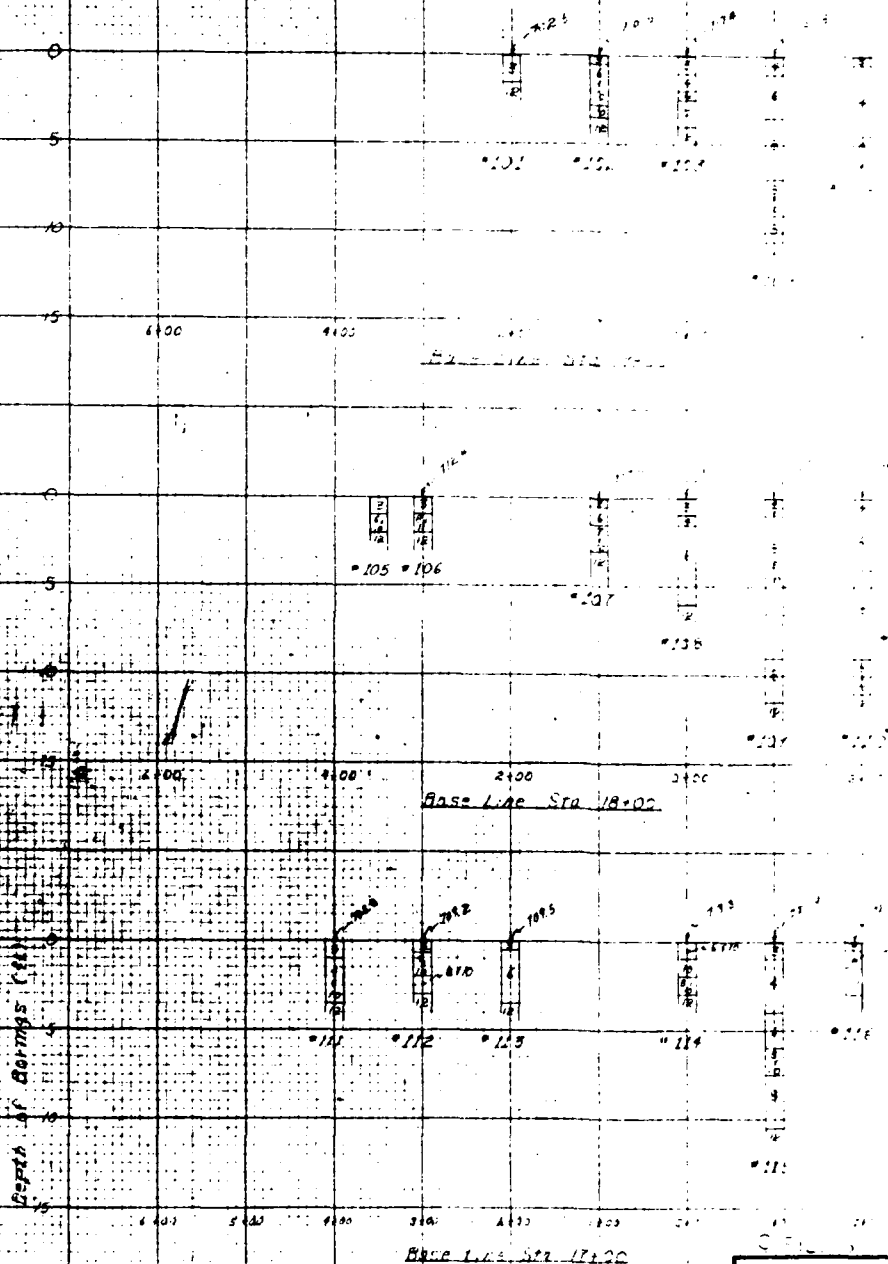
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

18 45620-H
3 3-E-45372-17

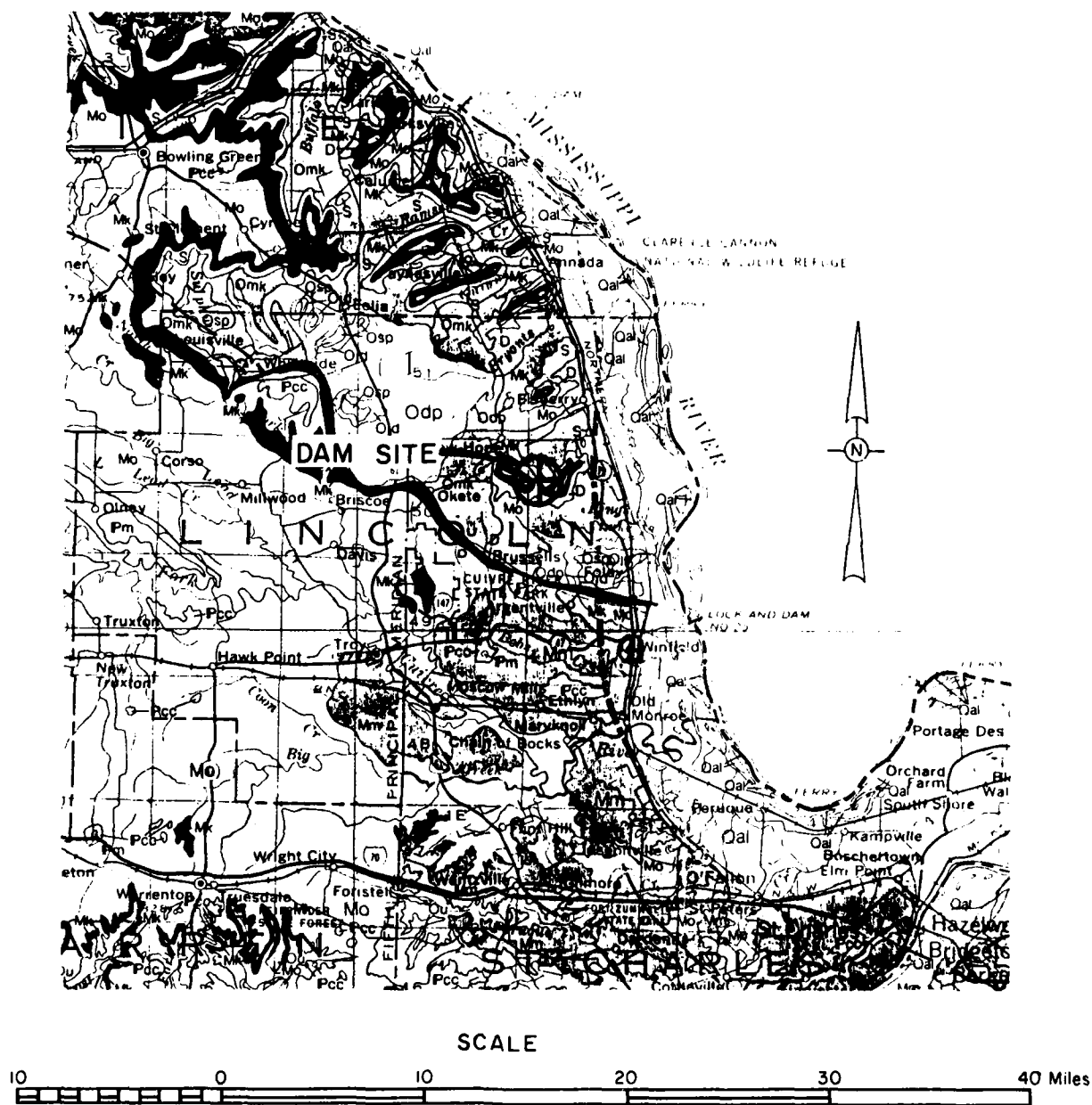
EMERGENCY

[illegible][illegible]





SURFACE ELEVATION BORROW AREA Lost Creek Watershed Soil Conservation District Madison, Indiana			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed	Date	Approved by	
Drawn		Title	
Traced		Scale	
Checked		Sheet	of 10
		No. 4	3-E-45670-C



⊕ LOCATION OF DAM
 NOTE: LEGEND OF THIS DAM IS ON PLATE 17

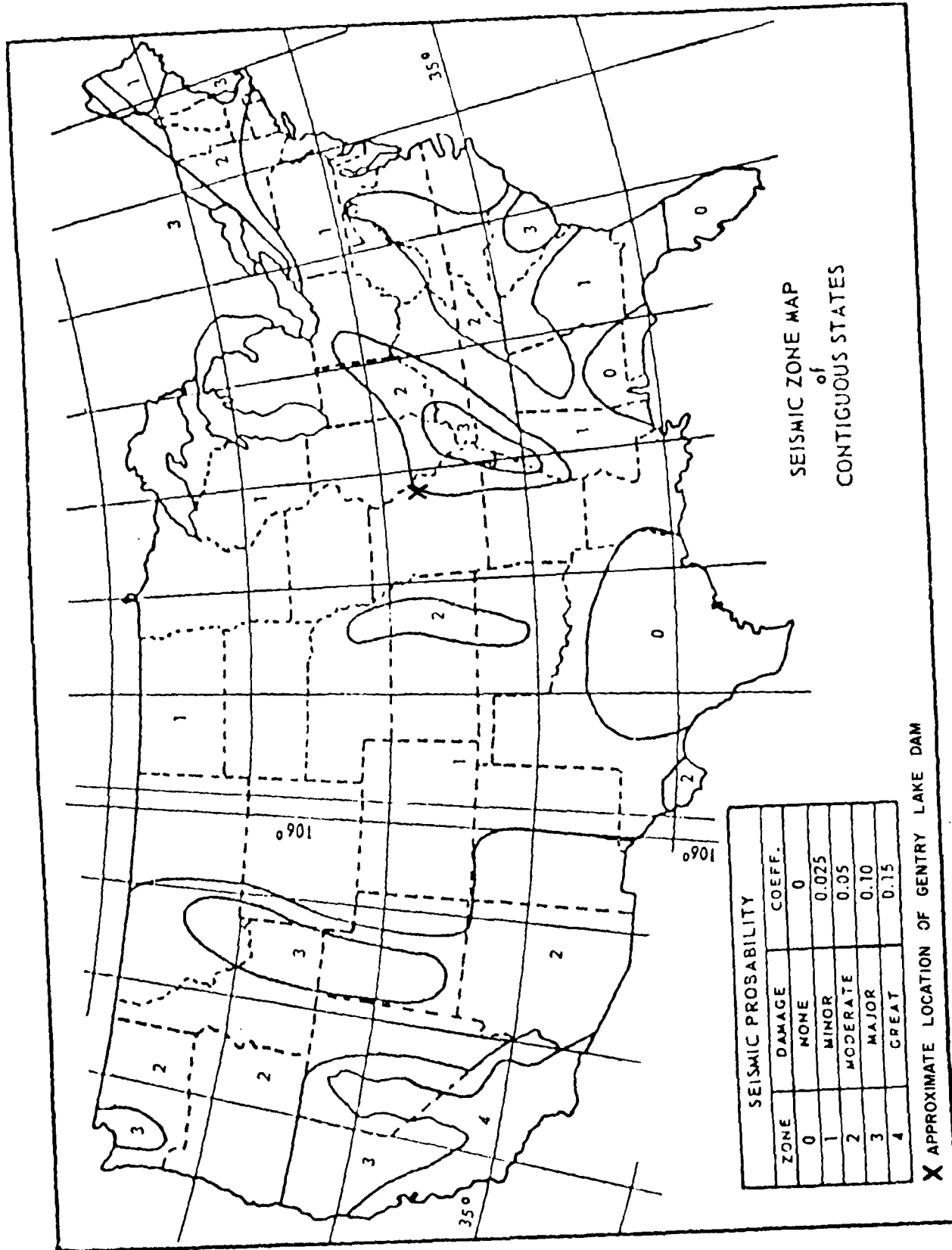
REFERENCE:

GEOLOGIC MAP OF MISSOURI
 DEPARTMENT OF NATURAL RESOURCES
 MISSOURI GEOLOGICAL SURVEY
 KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP
 OF
 GENTRY LAKE DAM

LEGEND

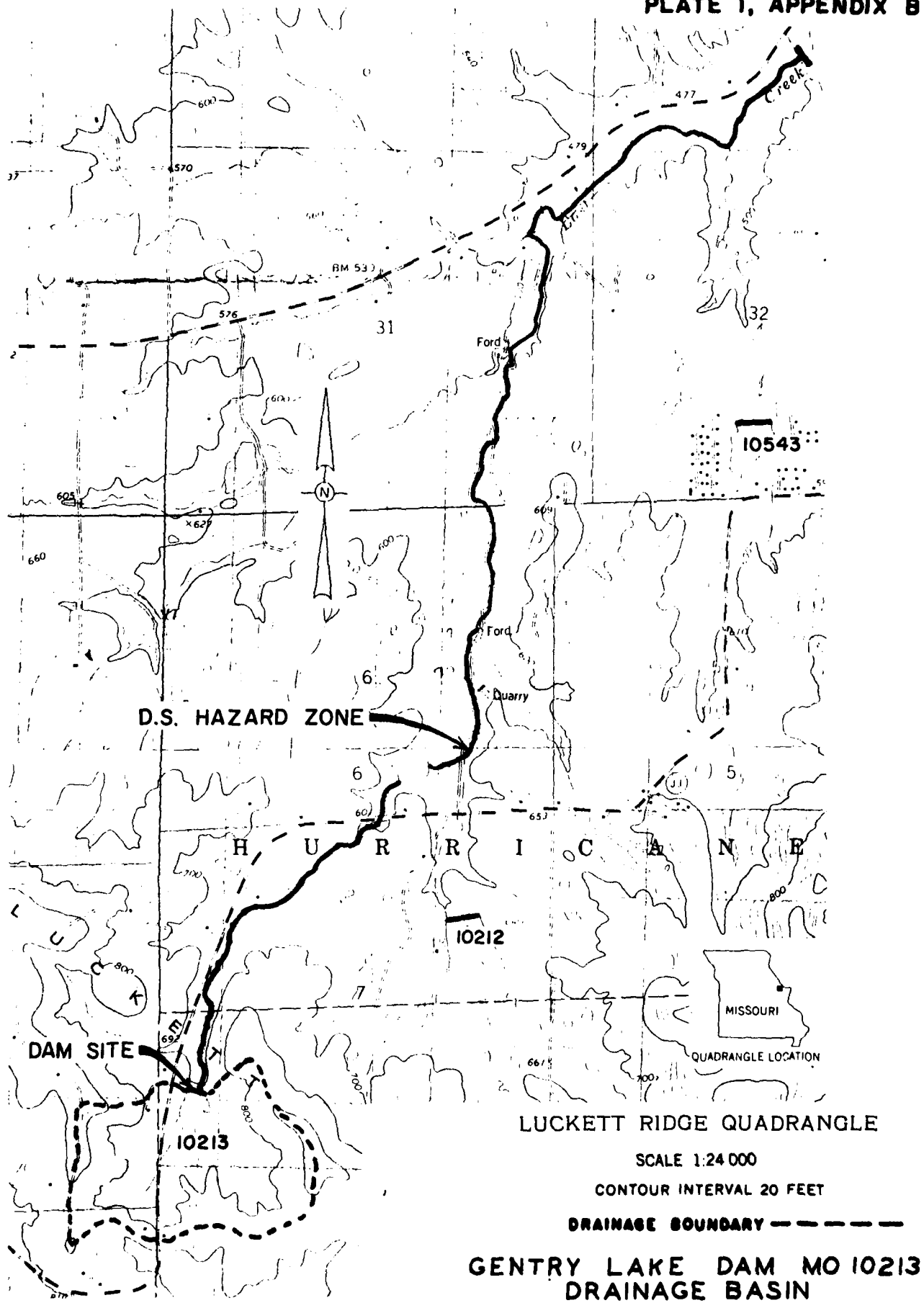
<u>PERIOD</u>	<u>SYMBOL</u>	<u>DESCRIPTION</u>
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
PENNSYLVANIAN	{ Pm	MARMATON GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
	{ Pcc	CHEROKEE GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
MISSISSIPPIAN	{ Mm	ST. LOUIS FORMATION: LIMESTONE INTERBEDDED WITH SHALE.
	{ Mm	SALEM FORMATION: LIMESTONE INTERBEDDED WITH SHALE AND SILTSTONE
	{ Mm	WARSAW FORMATION: ARGILLACEOUS LIMESTONE AND CALCAREOUS SHALE
	{ Mo	KEOKUK-BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	{ Mk	NORTHVIEW-COMPTON AND BACHELOR FORMATION
DEVONIAN	D	CHATTANOOGA SHALE SYLAMORE SANDSTONE
ORDOVICIAN	{ Omk	MAQUOKETA SHALE: KIMMSWICK LIMESTONE
	{ Odp	DECORAH FORMATION: GREEN TO GRAY CALCAREOUS SHALE WITH THIN FOSSILIFEROUS LIMESTONE



APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

PLATE I, APPENDIX B



DAM SAFETY INSPECTION/MISSOURI-1980

SHEET NO. 2 OF 2

GENTRY LAKE DAM

JOB NO. 1263

PRINCIPAL SPILLWAY DISCHARGE

BY MAS DATE 5-9-80

* Check for Orifice flow:

$$Q_o = 0.6 A \sqrt{2gh}$$

$$= 0.6 \times 785 \times 9 \sqrt{64.4 \times 1}$$

$$= \underline{\underline{34 \text{ cfs}}}$$

Orifice flow cannot occur.

DAM SAFETY INSPECTION / MISSOURI - 1980

SHEET NO. 1 OF 1

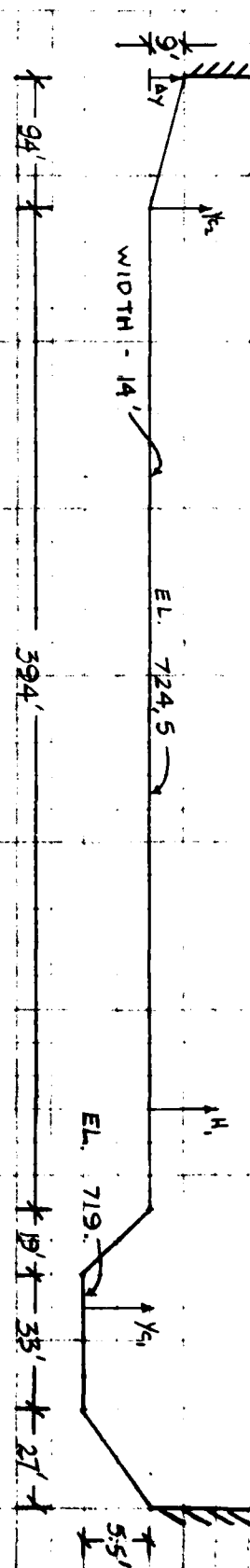
GENTRY LAKE DAM (MO 10213)

JOB NO. 1263

EMERGENCY SPILLWAY AND OVERTOP RATING CURVE BY JFK

DATE 5/14/80

Y_1	A_1	T_1	$Y_2 = \sqrt{\frac{A_1^3}{T_1}}$	$Y_1^2 / 2g$	$Q_1 = A_1 Y_1$	$U/S \text{ W.S.} = Y_1 + \frac{V_1^2}{2g}$	C_1	L_1	H_1	$Q_1 = C_1 L_1 H_1^{3/2}$	$Y_2 = \frac{3}{2} (H_1 + \frac{1}{4} \Delta Y)$	T_2	A_2	$Q_2 = \left(\frac{A_2^3}{T_2} \right)^{1/2}$	$Q_1 = Q_2 + Q_1 + Q_2$
0	0	0	0	0	0	719.	-	-	-	-	-	-	-	-	0
1	37.2	41.4	5.4	0.45	200.8	720.5	-	-	-	-	-	-	-	-	201
2	82.7	49.7	7.3	0.83	603.7	721.8	-	-	-	-	-	-	-	-	604
3	136.6	58.1	8.7	1.17	1188.4	723.2	-	-	-	-	-	-	-	-	1188
4	198.9	66.5	9.8	1.49	1949.2	724.5	-	-	-	-	-	-	-	-	1949
4.5	233.2	70.6	10.3	1.65	2402.0	725.1	2.70	394	0.6	494.4	0.5	5.22	1.31	3.7	2900
5	269.6	74.8	10.8	1.81	2911.7	725.8	2.64	394	1.3	1541.8	1.04	10.86	5.65	23.1	4477
5.5	308.0	79.0	11.2	1.95	3449.6	726.5	2.63	394	2.0	2930.9	1.6	16.70	13.36	67.8	6448
6	324.5	79.0	11.5	2.05	3731.8	727.0	2.63	394	2.5	4096.0	2.0	20.88	20.88	118.5	7946
8	390.5	79.0	12.6	2.47	4920.3	729.5	2.63	394	5.0	11585.3	4.0	41.76	83.52	670.2	17176
12	522.5	79.0	14.6	3.30	7628.5	734.3	2.63	394	9.8	31790.0	7.84	81.85	300.9	3605.6	43024



DAM SAFETY INSPECTION / MISSOURI - 1980

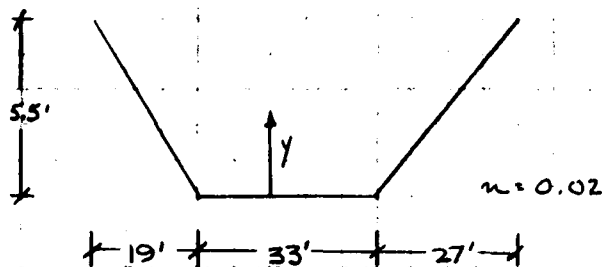
SHEET NO. 1 OF 1

GENTRY LAKE DAM (MO 10213)

JOB NO. 1263

CHECK EMERGENCY SPILLWAY SLOPE

BY JFK DATE 5/14/80



$$T = y (46/5.5) + 33$$

$$A = y (1/2 y (46/5.5) + 33)$$

$$Q = \left(\frac{8A^3}{T} \right)^{1/2} \quad \text{and} \quad S_c = \left[\frac{Q_c n}{1.49 A_c R_c^{2/3}} \right]^2$$

Mildest Slope in Spillway, $S = 6''/36' = 0.014$

for $y = 1$,

$$A = 37.2$$

$$T = 41.4$$

$$Q = 201$$

$$S_c = \left[\frac{201 (0.02)}{1.49 (37.2) (0.89)^{2/3}} \right]^2 = 0.006$$

$$S > S_c \quad \text{O.K.}$$

for $y = 5$,

$$A = 269.5$$

$$T = 74.8$$

$$Q = 2911.7$$

$$S_c = \left[\frac{2911.7 (0.02)}{1.49 (269.5) (3.55)^{2/3}} \right]^2 = 0.004$$

$$S > S_c \quad \text{O.K.}$$

\therefore The assumption of critical depth at the spillway crest is valid.

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI

SHEET NO. 1 OF 1

GENTRY LAKE DAM (MO 10213)

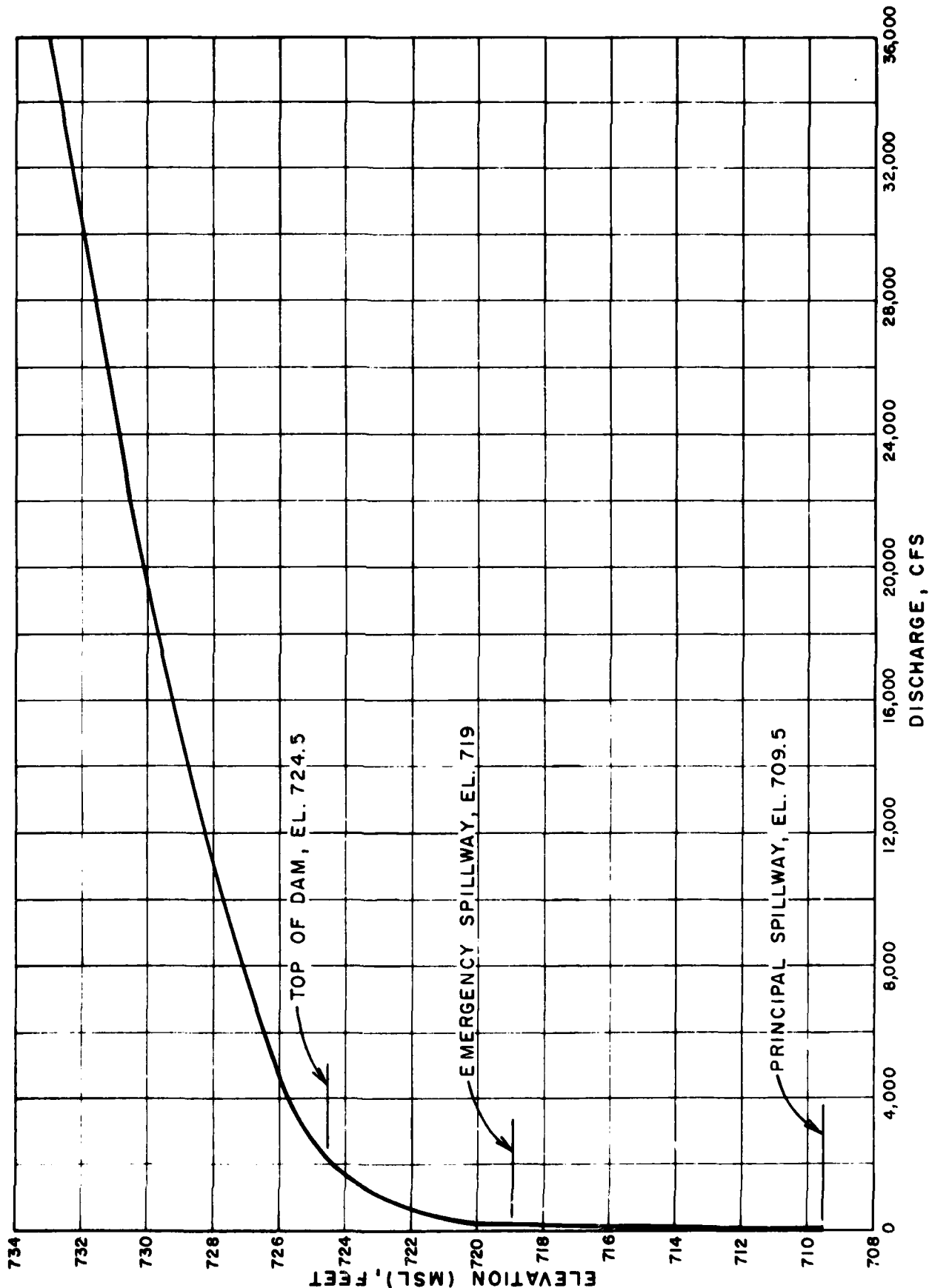
JOB NO. 1263

COMBINED RATING CURVE

BY JFK DATE 5/14/60

COMBINED SPILLWAYS AND OVERTOP RATING CURVE, TABULATION

RESERVOIR WATER SURFACE ELEVATION	PRINCIPAL SPILLWAY DISCHARGE	EMERGENCY SPILLWAY AND OVERTOP DISCHARGE	COMBINED DISCHARGE
709.5	0	0	0
710.0	11	0	11
710.2	19	0	19
710.5	26	0	26
711.0	26	0	26
715.0	29	0	29
719.0	32	0	32
720.0	33	135	168
720.5	33	201	234
721.8	34	604	638
723.2	35	1188	1223
724.5	36	1949	1985
725.1	36	2900	2936
725.8	36	4477	4513
726.5	37	6448	6485
727.0	37	7946	7983
729.5	39	17176	17215
734.3	41	43024	43065



GENTRY LAKE DAM (MO. 10213)
SPILLWAY & OVERTOP RATING CURVE

AD-A104 617

CONSOER TOWNSEND AND ASSOCIATES LTD ST LOUIS MO
NATIONAL DAM SAFETY PROGRAM. GENTRY LAKE DAM (MO 10213), MISSISS-ETC(U)
JUL 80 W G SHIFRIN
DACW43-80-C-0094

F/S 13/13

UNCLASSIFIED

NL

21+2

AD-A104 617



END
DATE
FILMED
10-81
DTIC

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION/MISCELLANEOUS

SHEET NO. 1 OF 1

GENTRY LAKE DAM

JOB NO. 1263

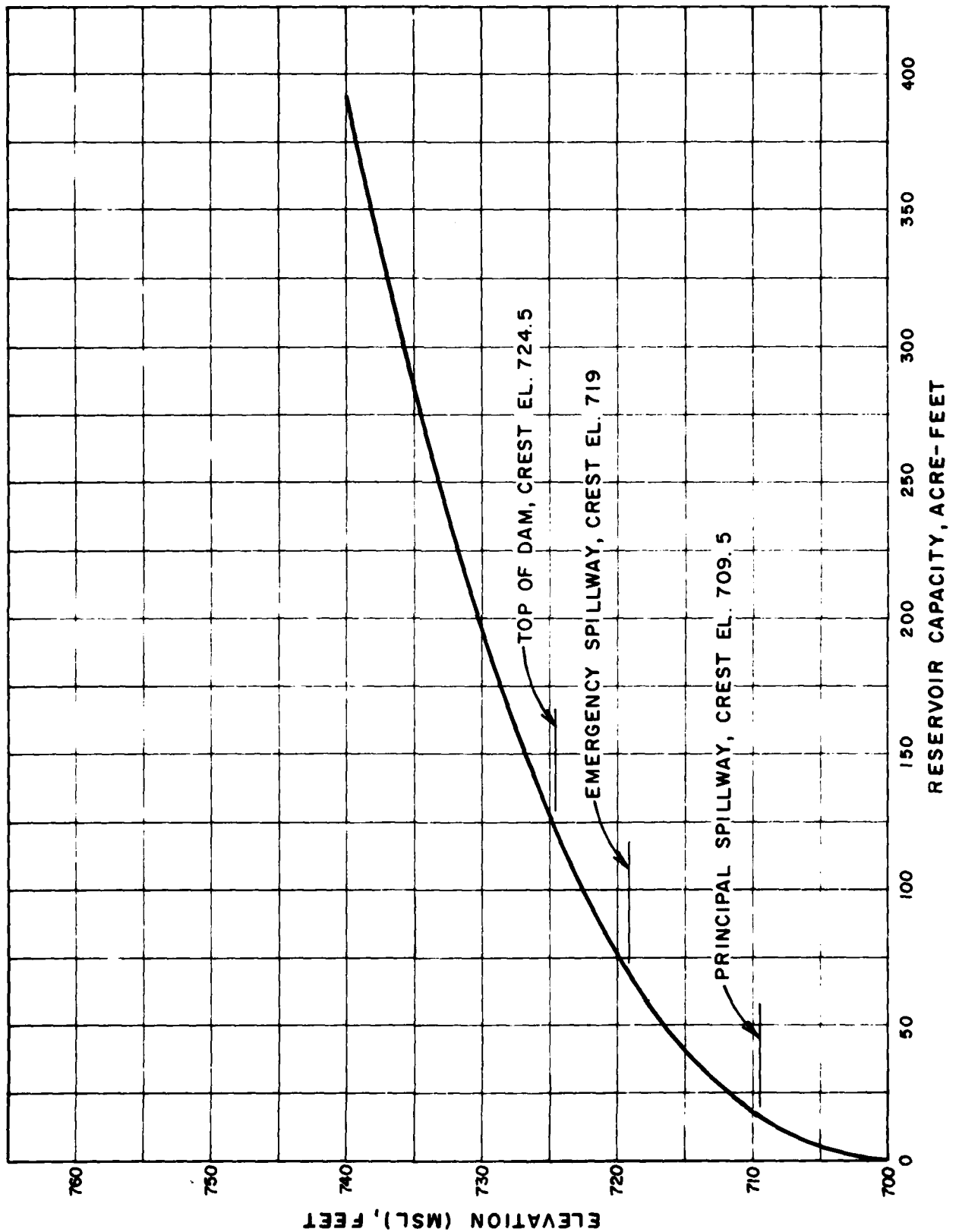
RESERVOIR AREA CAPACITY TABLE

BY MAG DATE 5-1-80

GENTRY LAKE DAM

RESERVOIR ELEV. AREA CAPACITY TABLE

Elevation (M.S.L.) Ft.	Reservoir Area (Acres)	Cumulative Storage (Ac. Ft.)	Remarks
700	0	0	→ Data from SCS Drawings
704.2	1.58	3.32	
707.2	2.62	9.62	
709.5	3.48	16.64	Principal Spillway Crest
710.2	3.92	19.20	Data from SCS Drawings
713.5	5.19	34.03	
716.0	6.38	48.51	Interspolated values at Emergency Spillway Crest
719.0	7.90	69.93	
720.0	8.40	78.11	
722.0	9.85	96.36	Data from SCS DWG.
724.5	11.70	123.0	Extrapolated area & capacity at top of dam
740	23	392	Area at El 740 is from USGS topo map.



GENTRY LAKE DAM (MO. 10213)
RESERVOIR CAPACITY CURVE

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI - 1980

SHEET NO. 1 OF 1

DAM NAME: GENTRY LAKE DAM (MO 10213)

JOB NO. 1263

PROBABLE MAXIMUM PRECIPITATION

BY JFK DATE 5/1/80

DETERMINATION OF PMP

- 1) Determine drainage area of the basin

$$D.A. = 0.29 \text{ sq. mi.}$$

- 2) Determine PMP Index Rainfall (for D.A. = 200 sq. mi. & 24 hr. duration)

Location of centroid of basin,

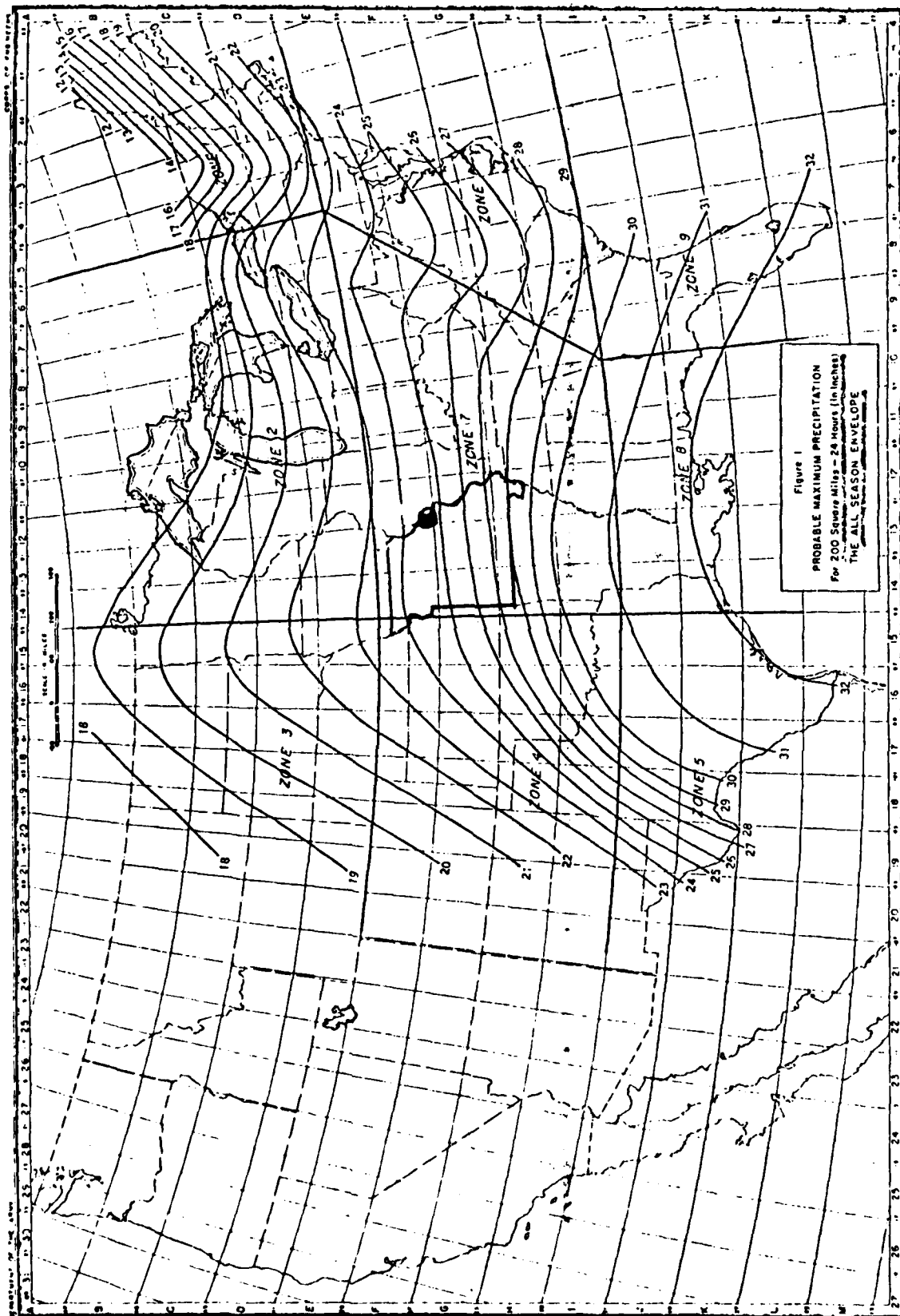
$$\text{Long.} = 90^{\circ} 50' 18'' \quad \text{Lat.} = 39^{\circ} 06' 37''$$

$$\text{PMP} = 24.7'' \quad (\text{from Fig. 1, HMR 33})$$

$$\text{Zone} = 7$$

- 3) Determine basin rainfall in terms of percentage of PMP Index Rainfall for various durations.
-
- (from Fig. 2, HMR 33)

Duration (Hrs.)	Percent of Index Rainfall (%)	Total Rainfall (Inches)	Rainfall Increments (Inches)	Duration of Increment (Hrs.)
6	100	24.7	24.7	6
12	120	29.6	4.9	6
24	130	32.1	2.5	12



⊗ Location of Centroid of Basin

GENTRY LAKE DAM

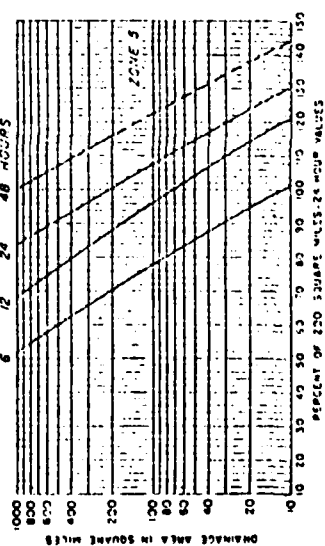
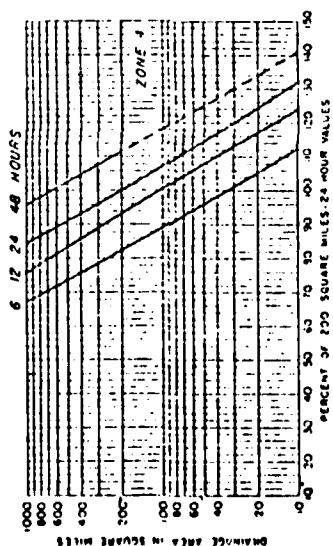
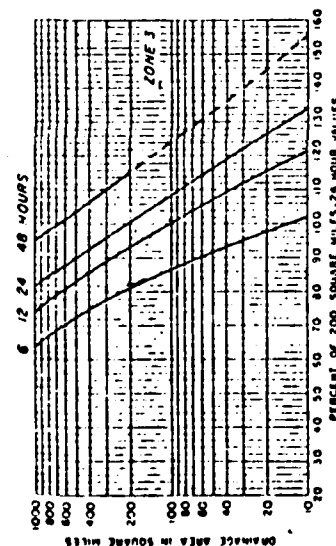
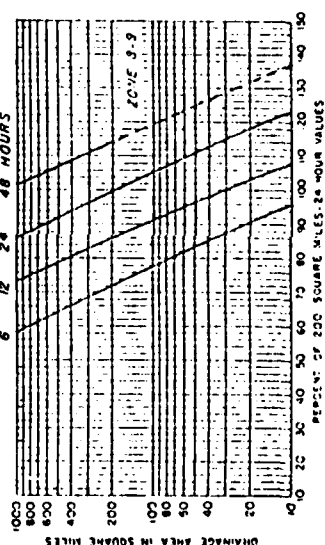
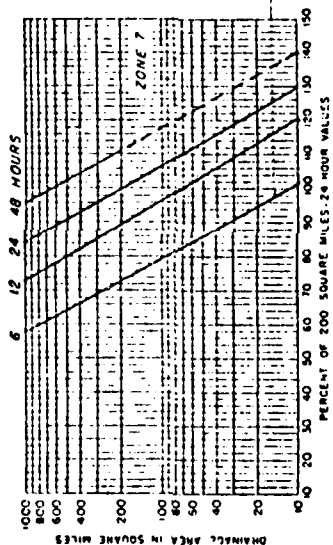
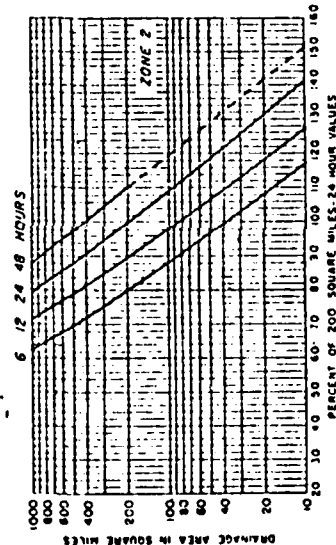
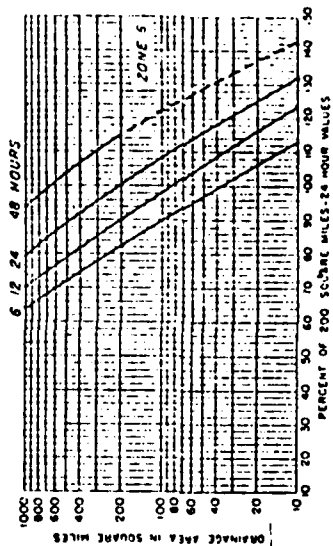
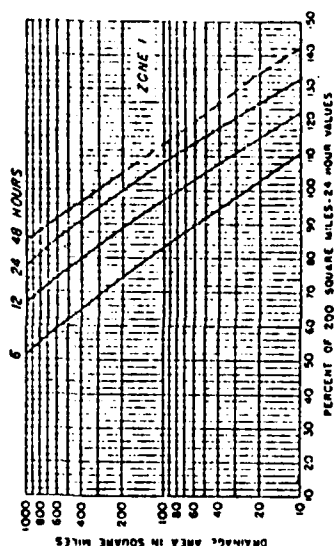


FIGURE 2
SEASONAL VARIATION
DEPTH-AREA-DURATION RELATIONSHIPS
Percentage to be applied to 200 square miles
24 hour probable maximum precipitation values
for: THE-ALL SEASON ENVELOPE

DAM SAFETY INSPECTION / MISSOURI - 1980

SHEET NO. 1 OF 1

DAM NAME: GENTRY LAKE DAM (MO 10213)

JOB NO. 1263

UNIT HYDROGRAPH PARAMETERS

BY JFK DATE 5/1/80

1) DRAINAGE AREA, $A = 0.29$ sq. mi. = (182.5 acres)2) LENGTH OF STREAM, $L = (1.4 \times 2000' = 2800') = 0.53$ mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$$H_1 = 900'$$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 709.5'$ 5) ELEVATION OF CHANNEL BED AT $0.85L$, $E_{85} = 860'$ 6) ELEVATION OF CHANNEL BED AT $0.10L$, $E_{10} = 715'$ 7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10}) / 0.75L = (860 - 715) / 2100 = 0.069$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$$t_c = [(11.9 \times L^3) / (H_1 - H_2)]^{0.385} = [11.9 \times (0.53)^3 / (900 - 709.5)]^{0.385} = 0.17 \text{ hr.}$$

B) BY VELOCITY ESTIMATE,

$$SLOPE = 0.069 \Rightarrow \text{AVG. VELOCITY} = 5 \text{ fps}$$

$$t_c = L / V = 2800 / (5 \times 3600) = 0.16 \text{ hr}$$

$$\text{USE } t_c = 0.17 \text{ hr}$$

9) LAG TIME, $t_L = 0.6 t_c = 0.6 (0.17) = 0.10 \text{ hr}$ 10) UNIT DURATION, $D \leq t_L / 3 = 0.10 / 3 = 0.033$

$$< 0.083 \text{ hr.}$$

$$\text{USE } D = 0.083 \text{ hr}$$

11) TIME TO PEAK, $T_p = D/2 + t_L = 0.083/2 + 0.10 = 0.14 \text{ hr}$

12) PEAK DISCHARGE,

$$q_p = (484 \times A) / T_p = 484 \times 0.29 / 0.14 = 1003 \text{ cfs}$$

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI

SHEET NO. 1 OF 1

DAM NAME: GENTRY LAKE DAM (MO 10213)

JOB NO. 1263

CURVE NUMBER DETERMINATION

BY JFK DATE 5/1/80

I) SOIL GROUP

WATERSHED SOILS IN THE BASIN CONSIST OF GROUP A.

A
B
C
D

GROUP C SOILS PREDOMINATE THE BASIN. THEREFORE,
ASSUME GROUP C SOILS FOR THE ENTIRE WATERSHED
FOR HYDROLOGIC PURPOSES.

II) COVER COMPLEX

ASSUMED HYDROLOGIC CONDITION OF THE WATERSHED: FAIR

LAND USE	PER CENT AREA	CN (AMC II)
WOODS	75	73
PASTURE OR RANGE	25	79

III) CURVE NUMBER

WEIGHTED AVERAGE CN = 75 FOR AMC II

CURVE NUMBER = 88 FOR AMC III

ECI-4

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI - 1980

 SHEET NO. 1 OF 1
GENTRY LAKE DAM (M.D. 10213)

 JOB NO. 1263
STARTING WATER SURFACE ELEVATION FOR PMF

 BY JFK DATE 5/15/80

$$S_i - S_f = \bar{Q} \Delta t$$

$$S_i - S_f / \bar{Q} = \Delta t$$

ELEV _i (ft)	ELEV _f (ft)	S _i (ac-ft)	S _f (ac-ft)	ΔS (ac-ft)	\bar{Q} (cfs)	Δt (hrs)
718.5	717	67	56	11	31	4.3
717	715	56	43	13	30	5.2
715	713	43	32	11	28.5	4.7
713	711	32	23	11	27	4.9
711	709.5	23	21	2	26	0.9
710.5	709.5	21	17	4	11	4.4
						$\Sigma = 24.4 \text{ hrs}$

TIME AT END OF INFLOW = 24.25 hrs

TOTAL TIME = 24.4 hrs. + 24.25 hrs = 48.65 hrs

= 2 days < 4 days

IF THE 1/2 PMF PRECEDES THE PMF BY 4 DAYS, THE RESERVOIR POOL WILL HAVE DRAINED TO THE LEVEL OF THE PRINCIPAL SPILLWAY WITHIN THAT TIME. THEREFORE, START THE PMF ROUTING AT THE PRINCIPAL SPILLWAY CREST ELEVATION.

HEC1DB INPUT DATA

[illegible]

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT C10213
RPTD HYDROGRAPH TO C10213
END OF SYSTEM

DATE: 11/05/15
TIME: 16:50:27

DATA SAFETY INSPECTION - MISCELL
CITY LINE (MO 10213)
BME A. 10 PERCENT PRA

JO SPECIFICATION

PLAY	IMP	INT	APPC	PLT	PORT	ASTA
0	0	0	0	0	0	0
0	0	0	0	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
PLAN = 1 NAME = LPIOT

ATTN: Mr. J. Edgar Hoover

CUJ3-2862 RUCYFF COMPUTATION.

INPUT PRECIPITATION, INCIDENCE, RATIO, AND UNIT HYDROGRAPH PARAMETERS

ISTP	ICOMP	LECON	TAPR	JPLT	JFRT	PAPR	STAGE	AUTO
01-21	0	0	0	0	0	1	0	0

MY:R07HAPI: DATA

	INSTRUMENT DATA	RATIO	ISOLATION	LOCAL
	TARGET	TRSCA	TRSPC	
IHYDR	10.16	0.70	1.00	1
	2	0.79	1.00	2

REC'D - AT&T

[illegible]

LCNS DATA

LAOBT	STNKS	ELTKE	RTTCL	LRAT	STNKS	MTDIX	CASTL	PLSMX	TIME
1	0.00	0.00	1.00	0.00	0.00	1.00	-0.00	0.00	0.00

CURVE NO = 045.00 WFNCS = -1.00 EFFECT CN = 08.00

U:11 MYDROG:2PH DAYZ
YC= 0.00 LAC= .10

SINTG= 0.0 ACCESSION DATA QRCSN= 0.00 RTIME= 1.00

TIME INCREMENT TOO LARGE--(MAY BE TRY LAG/2)

UNIT HYDROGRAPH. B END OF PERIOD MINUTES, TC= 0.00 HOURS, LAG= .10 VOL= 1.00

NO.	DATE	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW CFS	HP-MN	PERIOD	PAIN	EXCS	LOSS	COMP. Q
1001	10-25	1	.01	0.00	.01	1.01	12.35	151	.21	.20	.11	449.
1001	10-26	2	.01	0.00	.01	1.01	12.40	152	.21	.20	.11	450.
1001	10-27	3	.01	0.00	.01	1.01	12.45	153	.21	.20	.11	451.
1001	10-28	4	.01	0.00	.01	1.01	12.50	154	.21	.20	.11	452.
1001	10-29	5	.01	0.00	.01	1.01	12.55	155	.21	.20	.11	453.
1001	10-30	6	.01	0.00	.01	1.01	13.00	156	.21	.20	.11	454.
1001	10-31	7	.01	0.00	.01	1.01	13.05	157	.21	.20	.11	455.
1001	10-32	8	.01	0.00	.01	1.01	13.10	158	.21	.20	.11	456.
1001	10-33	9	.01	0.00	.01	1.01	13.15	159	.21	.20	.11	457.
1001	10-34	10	.01	0.00	.01	1.01	13.20	160	.21	.20	.11	458.
1001	10-35	11	.01	0.00	.01	1.01	13.25	161	.21	.20	.11	459.
1001	10-36	12	.01	0.00	.01	1.01	13.30	162	.21	.20	.11	460.
1001	10-37	13	.01	0.00	.01	1.01	13.35	163	.21	.20	.11	461.
1001	10-38	14	.01	0.00	.01	1.01	13.40	164	.21	.20	.11	462.
1001	10-39	15	.01	0.00	.01	1.01	13.45	165	.21	.20	.11	463.
1001	10-40	16	.01	0.00	.01	1.01	13.50	166	.21	.20	.11	464.
1001	10-41	17	.01	0.00	.01	1.01	13.55	167	.21	.20	.11	465.
1001	10-42	18	.01	0.00	.01	1.01	14.00	168	.21	.20	.11	466.
1001	10-43	19	.01	0.00	.01	1.01	14.05	169	.21	.20	.11	467.
1001	10-44	20	.01	0.00	.01	1.01	14.10	170	.21	.20	.11	468.
1001	10-45	21	.01	0.00	.01	1.01	14.15	171	.21	.20	.11	469.
1001	10-46	22	.01	0.00	.01	1.01	14.20	172	.21	.20	.11	470.
1001	10-47	23	.01	0.00	.01	1.01	14.25	173	.21	.20	.11	471.
1001	10-48	24	.01	0.00	.01	1.01	14.30	174	.21	.20	.11	472.
1001	10-49	25	.01	0.00	.01	1.01	14.35	175	.21	.20	.11	473.
1001	10-50	26	.01	0.00	.01	1.01	14.40	176	.21	.20	.11	474.
1001	10-51	27	.01	0.00	.01	1.01	14.45	177	.21	.20	.11	475.
1001	10-52	28	.01	0.00	.01	1.01	14.50	178	.21	.20	.11	476.
1001	10-53	29	.01	0.00	.01	1.01	14.55	179	.21	.20	.11	477.
1001	10-54	30	.01	0.00	.01	1.01	15.00	180	.21	.20	.11	478.
1001	10-55	31	.01	0.00	.01	1.01	15.05	181	.21	.20	.11	479.
1001	10-56	32	.01	0.00	.01	1.01	15.10	182	.21	.20	.11	480.
1001	10-57	33	.01	0.00	.01	1.01	15.15	183	.21	.20	.11	481.
1001	10-58	34	.01	0.00	.01	1.01	15.20	184	.21	.20	.11	482.
1001	10-59	35	.01	0.00	.01	1.01	15.25	185	.21	.20	.11	483.
1001	10-60	36	.01	0.00	.01	1.01	15.30	186	.21	.20	.11	484.
1001	10-61	37	.01	0.00	.01	1.01	15.35	187	.21	.20	.11	485.
1001	10-62	38	.01	0.00	.01	1.01	15.40	188	.21	.20	.11	486.
1001	10-63	39	.01	0.00	.01	1.01	15.45	189	.21	.20	.11	487.
1001	10-64	40	.01	0.00	.01	1.01	15.50	190	.21	.20	.11	488.
1001	10-65	41	.01	0.00	.01	1.01	15.55	191	.21	.20	.11	489.
1001	10-66	42	.01	0.00	.01	1.01	16.00	192	.21	.20	.11	490.
1001	10-67	43	.01	0.00	.01	1.01	16.05	193	.21	.20	.11	491.
1001	10-68	44	.01	0.00	.01	1.01	16.10	194	.21	.20	.11	492.
1001	10-69	45	.01	0.00	.01	1.01	16.15	195	.21	.20	.11	493.
1001	10-70	46	.01	0.00	.01	1.01	16.20	196	.21	.20	.11	494.
1001	10-71	47	.01	0.00	.01	1.01	16.25	197	.21	.20	.11	495.
1001	10-72	48	.01	0.00	.01	1.01	16.30	198	.21	.20	.11	496.
1001	10-73	49	.01	0.00	.01	1.01	16.35	199	.21	.20	.11	497.
1001	10-74	50	.01	0.00	.01	1.01	16.40	200	.21	.20	.11	498.
1001	10-75	51	.01	0.00	.01	1.01	16.45	201	.21	.20	.11	499.
1001	10-76	52	.01	0.00	.01	1.01	16.50	202	.21	.20	.11	500.
1001	10-77	53	.01	0.00	.01	1.01	16.55	203	.21	.20	.11	501.
1001	10-78	54	.01	0.00	.01	1.01	17.00	204	.21	.20	.11	502.
1001	10-79	55	.01	0.00	.01	1.01	17.05	205	.21	.20	.11	503.
1001	10-80	56	.01	0.00	.01	1.01	17.10	206	.21	.20	.11	504.
1001	10-81	57	.01	0.00	.01	1.01	17.15	207	.21	.20	.11	505.
1001	10-82	58	.01	0.00	.01	1.01	17.20	208	.21	.20	.11	506.
1001	10-83	59	.01	0.00	.01	1.01	17.25	209	.21	.20	.11	507.
1001	10-84	60	.01	0.00	.01	1.01	17.30	210	.21	.20	.11	508.
1001	10-85	61	.01	0.00	.01	1.01	17.35	211	.21	.20	.11	509.
1001	10-86	62	.01	0.00	.01	1.01	17.40	212	.21	.20	.11	510.
1001	10-87	63	.01	0.00	.01	1.01	17.45	213	.21	.20	.11	511.
1001	10-88	64	.01	0.00	.01	1.01	17.50	214	.21	.20	.11	512.
1001	10-89	65	.01	0.00	.01	1.01	17.55	215	.21	.20	.11	513.
1001	10-90	66	.01	0.00	.01	1.01	18.00	216	.21	.20	.11	514.
1001	10-91	67	.01	0.00	.01	1.01	18.05	217	.21	.20	.11	515.
1001	10-92	68	.01	0.00	.01	1.01	18.10	218	.21	.20	.11	516.
1001	10-93	69	.01	0.00	.01	1.01	18.15	219	.21	.20	.11	517.
1001	10-94	70	.01	0.00	.01	1.01	18.20	220	.21	.20	.11	518.
1001	10-95	71	.01	0.00	.01	1.01	18.25	221	.21	.20	.11	519.
1001	10-96	72	.01	0.00	.01	1.01	18.30	222	.21	.20	.11	520.
1001	10-97	73	.01	0.00	.01	1.01	18.35	223	.21	.20	.11	521.
1001	10-98	74	.01	0.00	.01	1.01	18.40	224	.21	.20	.11	522.
1001	10-99	75	.01	0.00	.01	1.01	18.45	225	.21	.20	.11	523.
1001	10-100	76	.01	0.00	.01	1.01	18.50	226	.21	.20	.11	524.
1001	10-101	77	.01	0.00	.01	1.01	18.55	227	.21	.20	.11	525.
1001	10-102	78	.01	0.00	.01	1.01	19.00	228	.21	.20	.11	526.
1001	10-103	79	.01	0.00	.01	1.01	19.05	229	.21	.20	.11	527.
1001	10-104	80	.01	0.00	.01	1.01	19.10	230	.21	.20	.11	528.
1001	10-105	81	.01	0.00	.01	1.01	19.15	231	.21	.20	.11	529.
1001	10-106	82	.01	0.00	.01	1.01	19.20	232	.21	.20	.11	530.
1001	10-107	83	.01	0.00	.01	1.01	19.25	233	.21	.20	.11	531.
1001	10-108	84	.01	0.00	.01	1.01	19.30	234	.21	.20	.11	532.
1001	10-109	85	.01	0.00	.01	1.01	19.35	235	.21	.20	.11	533.
1001	10-110	86	.01	0.00	.01	1.01	19.40	236	.21	.20	.11	534.
1001	10-111	87	.01	0.00	.01	1.01	19.45	237	.21	.20	.11	535.
1001	10-112	88	.01	0.00	.01	1.01	19.50	238	.21	.20	.11	536.
1001	10-113	89	.01	0.00	.01	1.01	19.55	239	.21	.20	.11	537.
1001	10-114	90	.01	0.00	.01	1.01	20.00	240	.21	.20	.11	538.
1001	10-115	91	.01	0.00	.01	1.01	20.05	241	.21	.20	.11	539.
1001	10-116	92	.01	0.00	.01	1.01	20.10	242	.21	.20	.11	540.
1001	10-117	93	.01	0.00	.01	1.01	20.15	243	.21	.20	.11	541.
1001	10-118	94	.01	0.00	.01	1.01	20.20	244	.21	.20	.11	542.
1001	10-119	95	.01	0.00	.01	1.01	20.25	245	.21	.20	.11	543.
1001	10-120	96	.01	0.00	.01	1.01	20.30	246	.21	.20	.11	544.
1001	10-121	97	.01	0.00	.01	1.01	20.35	247	.21	.20	.11	545.
1001	10-122	98	.01	0.00	.01	1.01	20.40	248	.21	.20	.11	546.
1001	10-123	99	.01	0.00	.01	1.01	20.45	249	.21	.20	.11	547.
1001	10-124	100	.01	0.00	.01	1.01	20.50	250	.21	.20	.11	548.

1.01	4.45	54	.01	14.	1.01	17.11	207	.23	.27	.00	548.
1.01	4.45	57	.01	14.	1.01	17.15	207	.23	.27	.00	523.
1.01	4.50	55	.01	14.	1.01	17.20	209	.23	.23	.00	513.
1.01	4.55	57	.01	14.	1.01	17.25	209	.23	.23	.00	509.
1.01	5.00	57	.01	14.	1.01	17.30	210	.23	.23	.00	508.
1.01	5.05	57	.01	14.	1.01	17.35	211	.23	.23	.00	507.
1.01	5.10	57	.01	14.	1.01	17.40	212	.23	.23	.00	507.
1.01	5.15	57	.01	14.	1.01	17.45	213	.23	.23	.00	507.
1.01	5.20	57	.01	14.	1.01	17.50	214	.23	.23	.00	507.
1.01	5.25	57	.01	14.	1.01	17.55	215	.23	.23	.00	507.
1.01	5.30	57	.01	14.	1.01	18.00	216	.23	.23	.00	507.
1.01	5.35	57	.01	14.	1.01	18.05	217	.02	.02	.00	377.
1.01	5.40	57	.01	14.	1.01	18.10	218	.02	.02	.00	164.
1.01	5.45	57	.01	14.	1.01	18.15	219	.02	.02	.00	99.
1.01	5.50	57	.01	14.	1.01	18.20	220	.02	.02	.00	54.
1.01	5.55	57	.01	14.	1.01	18.25	221	.02	.02	.00	54.
1.01	5.60	57	.01	14.	1.01	18.30	222	.02	.02	.00	42.
1.01	5.65	57	.01	14.	1.01	18.35	223	.02	.02	.00	47.
1.01	5.70	57	.01	14.	1.01	18.40	224	.02	.02	.00	46.
1.01	5.75	57	.01	14.	1.01	18.45	225	.02	.02	.00	41.
1.01	5.80	57	.01	14.	1.01	18.50	226	.02	.02	.00	46.
1.01	5.85	57	.01	14.	1.01	18.55	227	.02	.02	.00	46.
1.01	5.90	57	.01	14.	1.01	19.00	228	.02	.02	.00	46.
1.01	5.95	57	.01	14.	1.01	19.05	229	.02	.02	.00	46.
1.01	6.00	57	.01	14.	1.01	19.10	230	.02	.02	.00	46.
1.01	6.05	57	.01	14.	1.01	19.15	231	.02	.02	.00	46.
1.01	6.10	57	.01	14.	1.01	19.20	232	.02	.02	.00	46.
1.01	6.15	57	.01	14.	1.01	19.25	233	.02	.02	.00	46.
1.01	6.20	57	.01	14.	1.01	19.30	234	.02	.02	.00	46.
1.01	6.25	57	.01	14.	1.01	19.35	235	.02	.02	.00	46.
1.01	6.30	57	.01	14.	1.01	19.40	236	.02	.02	.00	46.
1.01	6.35	57	.01	14.	1.01	19.45	237	.02	.02	.00	46.
1.01	6.40	57	.01	14.	1.01	19.50	238	.02	.02	.00	46.
1.01	6.45	57	.01	14.	1.01	19.55	239	.02	.02	.00	46.
1.01	6.50	57	.01	14.	1.01	20.00	240	.02	.02	.00	46.
1.01	6.55	57	.01	14.	1.01	20.05	241	.02	.02	.00	46.
1.01	6.60	57	.01	14.	1.01	20.10	242	.02	.02	.00	46.
1.01	6.65	57	.01	14.	1.01	20.15	243	.02	.02	.00	46.
1.01	6.70	57	.01	14.	1.01	20.20	244	.02	.02	.00	46.
1.01	6.75	57	.01	14.	1.01	20.25	245	.02	.02	.00	46.
1.01	6.80	57	.01	14.	1.01	20.30	246	.02	.02	.00	46.
1.01	6.85	57	.01	14.	1.01	20.35	247	.02	.02	.00	46.
1.01	6.90	57	.01	14.	1.01	20.40	248	.02	.02	.00	46.
1.01	6.95	57	.01	14.	1.01	20.45	249	.02	.02	.00	46.
1.01	7.00	57	.01	14.	1.01	20.50	250	.02	.02	.00	46.
1.01	7.05	57	.01	14.	1.01	20.55	251	.02	.02	.00	46.
1.01	7.10	57	.01	14.	1.01	21.00	252	.02	.02	.00	46.
1.01	7.15	57	.01	14.	1.01	21.05	253	.02	.02	.00	46.
1.01	7.20	57	.01	14.	1.01	21.10	254	.02	.02	.00	46.
1.01	7.25	57	.01	14.	1.01	21.15	255	.02	.02	.00	46.
1.01	7.30	57	.01	14.	1.01	21.20	256	.02	.02	.00	46.
1.01	7.35	57	.01	14.	1.01	21.25	257	.02	.02	.00	46.
1.01	7.40	57	.01	14.	1.01	21.30	258	.02	.02	.00	46.
1.01	7.45	57	.01	14.	1.01	21.35	259	.02	.02	.00	46.
1.01	7.50	57	.01	14.	1.01	21.40	260	.02	.02	.00	46.
1.01	7.55	57	.01	14.	1.01	21.45	261	.02	.02	.00	46.
1.01	7.60	57	.01	14.	1.01	21.50	262	.02	.02	.00	46.
1.01	7.65	57	.01	14.	1.01	21.55	263	.02	.02	.00	46.
1.01	7.70	57	.01	14.	1.01	22.00	264	.02	.02	.00	46.
1.01	7.75	57	.01	14.	1.01	22.05	265	.02	.02	.00	46.

FLOOD ROUTING

[illegible]

BEAM OUTFLOW IS : 135. AT TIME 10.3. HUC-

FAV	2-4-6-8	2-4-6-8	7-9-10-11	TOTAL
110	51	12	91	2732
100	52	3	5	771
100	100	15	12	1513
100	200	50	50	3961
100	100	100	100	100
100	100	100	200	200
100	100	100	200	200

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

107. FLOW AND STRESS LINE OF DESIGN SUMMARY FOR MULTIPLE PLANT-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 DATA IN SQUARE MILES (SQUARE KILOMETERS)

VALUES APPLIED TO FLOWS

COMPUTATION	LOCATION	AREA	CAN. RATIO		RATIO P
			1905	1940	
OF FLOW	OF THE	AREA	1	1.14	1940
				1.14	1940
OF FLOW	OF THE	AREA	1	1.14	1940
				1.14	1940
OF FLOW	OF THE	AREA	1	1.14	1940
				1.14	1940

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 736.50 17. 6.	SPILLWAY CREST 709.50 17. 6.	TOP OF DAM 724.50 123. 1985.	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	ELEVATION OVER TOP HOURLY	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
Ratio of PPE	MAXIMUM RESERVOIR 24.5-ELL.	736.50 17. 6.	709.50 17. 6.	724.50 123. 1985.	17. 13.	2780. 113.	73 6.00	15.75 15.03	0.00 0.00
1.00 0.00	736.50 17. 6.	736.50 17. 6.	709.50 17. 6.	724.50 123. 1985.	17. 13.	2780. 113.	73 6.00	15.75 15.03	0.00 0.00

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAN SAFETY VERSION JULY 1978
 LAST MODIFICATION 28 FEB 79

DAM SAFETY INSPECTION - MISSOURI									
GENTRY LAKE DAM (MO 10213)									
PERCENT PMF									
1	300	0	5	0	0	0	0	-4	0
2	5								
3	1	4	1						
4	.75	.77	.78	.20					
5	0	MO10213							
6	1	2	.29	1					
7	1	24.7	130	120	130				
8	1	.1	1						
9	0	0	1						
10	1	MO10213		0	0	1			
11	1	ROUTE HYDROGRAPH THROUGH GENTRY LAKE DAM (MO 10213)		1	1				
12	1	1							
13	1	709.5	710.2	710.5	711	715	-709.5	-1	
14	1	723.2	725.1	725.8	726.5	727	729.5	720	721.8
15	1	11	19	26	26	29	32	734.3	
16	1	1223	1985	4513	6485	7982	17215	168	638
17	1	3.32	5.62	16.64	19.2	34.03	48.51	43065	
18	1	123	292					69.93	96.36
19	1	720	707.2	709.5	710.2	713.5	716	719	722
20	1	724.5							
21	1	709.5							
22	1	724.5							
23	1	99							

PREVIEW OF SEQUENCE OF STEEP NETWORK CALCULATIONS

UNOFF. HYDROGRAPH AT 010213
ROUT. HYDROGRAPH TO 010213
END OF NETWORK

ML DATE: 1/30/50
FILE: 1001-51

PROPERTY INSPECTION - MISSOURI
CITY LAKE DA. CO. 1021A)
FOOTING

NOTICE

[illegible]

1. 2011.7.9-2011.7.10
2011.7.11-2011.7.12

1977

[illegible]

UNIT HYPERGRAPH PATIENS
NOTIFICATION AND
0017684901

DATE	TIME	LOCATION	STATUS	REMARKS
1900	1200	1000	1000	1000
1901	1200	1000	1000	1000
1902	1200	1000	1000	1000
1903	1200	1000	1000	1000
1904	1200	1000	1000	1000
1905	1200	1000	1000	1000
1906	1200	1000	1000	1000
1907	1200	1000	1000	1000
1908	1200	1000	1000	1000
1909	1200	1000	1000	1000
1910	1200	1000	1000	1000
1911	1200	1000	1000	1000
1912	1200	1000	1000	1000
1913	1200	1000	1000	1000
1914	1200	1000	1000	1000
1915	1200	1000	1000	1000
1916	1200	1000	1000	1000
1917	1200	1000	1000	1000
1918	1200	1000	1000	1000
1919	1200	1000	1000	1000
1920	1200	1000	1000	1000
1921	1200	1000	1000	1000
1922	1200	1000	1000	1000
1923	1200	1000	1000	1000
1924	1200	1000	1000	1000
1925	1200	1000	1000	1000
1926	1200	1000	1000	1000
1927	1200	1000	1000	1000
1928	1200	1000	1000	1000
1929	1200	1000	1000	1000
1930	1200	1000	1000	1000
1931	1200	1000	1000	1000
1932	1200	1000	1000	1000
1933	1200	1000	1000	1000
1934	1200	1000	1000	1000
1935	1200	1000	1000	1000
1936	1200	1000	1000	1000
1937	1200	1000	1000	1000
1938	1200	1000	1000	1000
1939	1200	1000	1000	1000
1940	1200	1000	1000	1000
1941	1200	1000	1000	1000
1942	1200	1000	1000	1000
1943	1200	1000	1000	1000
1944	1200	1000	1000	1000
1945	1200	1000	1000	1000
1946	1200	1000	1000	1000
1947	1200	1000	1000	1000
1948	1200	1000	1000	1000
1949	1200	1000	1000	1000
1950	1200	1000	1000	1000
1951	1200	1000	1000	1000
1952	1200	1000	1000	1000
1953	1200	1000	1000	1000
1954	1200	1000	1000	1000
1955	1200	1000	1000	1000
1956	1200	1000	1000	1000
1957	1200	1000	1000	1000
1958	1200	1000	1000	1000
1959	1200	1000	1000	1000
1960	1200	1000	1000	1000
1961	1200	1000	1000	1000
1962	1200	1000	1000	1000
1963	1200	1000	1000	1000
1964	1200	1000	1000	1000
1965	1200	1000	1000	1000
1966	1200	1000	1000	1000
1967	1200	1000	1000	1000
1968	1200	1000	1000	1000
1969	1200	1000	1000	1000
1970	1200	1000	1000	1

HYCROGRAPH. DATE

TYPE	TIME	TRF	TRSC	TRSC	RATIO	ISLOW	LOCAL
1	2	0.00	0.00	1.00	0.00		

ENCLOSURE DATA

	ppm	R ₁ S	R ₂ H	R ₄ H	ms
CH ₃ -C(=O)-	170				172
C=C-O-	165				174
C=C-C(=O)-	160				176
C=C-C(=O)-	155				178
C=C-C(=O)-	150				180
C=C-C(=O)-	145				182
C=C-C(=O)-	140				184
C=C-C(=O)-	135				186
C=C-C(=O)-	130				188
C=C-C(=O)-	125				190
C=C-C(=O)-	120				192
C=C-C(=O)-	115				194
C=C-C(=O)-	110				196
C=C-C(=O)-	105				198
C=C-C(=O)-	100				200
C=C-C(=O)-	95				202
C=C-C(=O)-	90				204
C=C-C(=O)-	85				206
C=C-C(=O)-	80				208
C=C-C(=O)-	75				210
C=C-C(=O)-	70				212
C=C-C(=O)-	65				214
C=C-C(=O)-	60				216
C=C-C(=O)-	55				218
C=C-C(=O)-	50				220
C=C-C(=O)-	45				222
C=C-C(=O)-	40				224
C=C-C(=O)-	35				226
C=C-C(=O)-	30				228
C=C-C(=O)-	25				230
C=C-C(=O)-	20				232
C=C-C(=O)-	15				234
C=C-C(=O)-	10				236
C=C-C(=O)-	5				238
C=C-C(=O)-	0				240

105. 1:22

SLIGHT	STOPS	DELTA	WIND	STOPS	RICH	STATE	CASEL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	1.00	-1.00	-2.00	0.00	0.00

$\cos \alpha = \frac{N_1}{L} = \frac{0.97}{1.06} = 0.91$

UNIT 7 HYDROGRAPH DATA

TC= C.57 LAG= .10

SESSION DATA

```

STRUC= 0.00  GRCSN= 0.00  PY10M= 1.00

```

NY-95-00017 FLW

[illegible]

[illegible]

REPORT BY THE SECRETARY OF THE ARMY TO THE SECRETARY OF THE ARMY

ESTAB	COV.	FROM	THRU	JULY	APRIL	MAY	JUNE	ESTAB	ESTAB
010015	1	1	1	0	0	1	1	0	1

[illegible]

ACT	ASTOL	LAG	PHASE	PK	STDEV	SPRAT
1	2		0.000	0.000	-7.0	-1

[illegible]

Year	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100																																																																																	
1960	11.6	12.0	12.4	12.8	13.2	13.6	14.0	14.4	14.8	15.2	15.6	16.0	16.4	16.8	17.2	17.6	18.0	18.4	18.8	19.2	19.6	20.0	20.4	20.8	21.2	21.6	22.0	22.4	22.8	23.2	23.6	24.0	24.4	24.8	25.2	25.6	26.0	26.4	26.8	27.2	27.6	28.0	28.4	28.8	29.2	29.6	30.0	30.4	30.8	31.2	31.6	32.0	32.4	32.8	33.2	33.6	34.0	34.4	34.8	35.2	35.6	36.0	36.4	36.8	37.2	37.6	38.0	38.4	38.8	39.2	39.6	40.0	40.4	40.8	41.2	41.6	42.0	42.4	42.8	43.2	43.6	44.0	44.4	44.8	45.2	45.6	46.0	46.4	46.8	47.2	47.6	48.0	48.4	48.8	49.2	49.6	50.0	50.4	50.8	51.2	51.6	52.0	52.4	52.8	53.2	53.6	54.0	54.4	54.8	55.2	55.6	56.0	56.4	56.8	57.2	57.6	58.0	58.4	58.8	59.2	59.6	60.0	60.4	60.8	61.2	61.6	62.0	62.4	62.8	63.2	63.6	64.0	64.4	64.8	65.2	65.6	66.0	66.4	66.8	67.2	67.6	68.0	68.4	68.8	69.2	69.6	70.0	70.4	70.8	71.2	71.6	72.0	72.4	72.8	73.2	73.6	74.0	74.4	74.8	75.2	75.6	76.0	76.4	76.8	77.2	77.6	78.0	78.4	78.8	79.2	79.6	80.0	80.4	80.8	81.2	81.6	82.0	82.4	82.8	83.2	83.6	84.0	84.4	84.8	85.2	85.6	86.0	86.4	86.8	87.2	87.6	88.0	88.4	88.8	89.2	89.6	90.0	90.4	90.8	91.2	91.6	92.0	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.8	97.2	97.6	98.0	98.4	98.8	99.2	99.6	100.0

10

79.	710.	710.	710.
79.	710.	710.	710.

Сод.	Сод.	Сод.	Сод.	Сод.	Сод.	Сод.
1	2	3	4	5	6	7

1957-7
COUNCIL
DATA
1957-7

Y 101 f 1 . 75 - GURS

IT TIME IF YOU'RE

TABLE 1. 1975-1976

Y TIME 15.7. FOUR.5

.....

.....

.....

.....

AREA FLOW AND STONE (CUBIC FEET PER SECOND) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

PER/SEC	STATION	AREA	PLAN RATIO	RATIOS APPLIED TO FLOW		
				1	2	3
				.75	.77	.78
HYDROGRAPH AT 01021						
		1.00	1	101%	101%	101%
		1.00	1	93.23%	93.23%	93.23%
ROUTE 1						
		1.00	1	101%	101%	101%
		1.00	1	93.23%	93.23%	93.23%

1491

EVALUATION:
 STORAGE:
 OUTPUT:

INITIAL VALUE
700.50
17.
0.

SPILL: AY CHEST
709.50
17.
0.

TOP OF DAM
724.50
123.
1945.

RATIO OF PWF	MAXIMUM RESERVOIR BASELLE	MAXIMUM DEPTH OVER GR	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TYPE OF "AN OUTFLOW HOURS	TIME OF FAILURE HOURS
.75	724.27	0.00	121.	1848.	0.00	15.75	0.00
.77	724.35	0.00	122.	1805.	0.00	15.75	3.00
.78	724.41	0.00	123.	1754.	0.00	15.75	6.00
.79	724.45	.1	124.	1696.	.00	15.75	9.00